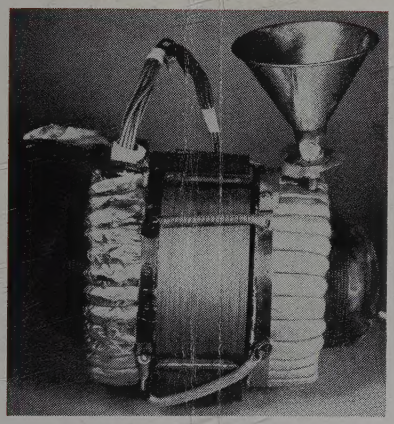
March 1961

Insulation



Epoxy motor encapsulation . . . page 33

In this issue:

NEW FROM BENTLEY-HARRIS . . .

BH ACRYL-A

(Grade B-A-1::7000 volts minimum average)

BH ACRYL-C

(Grade B-C-1::2500 volts minimum average)

COMPATIBILITY UNLIMITED

Compatible with all known wire enamels (polyester, epoxy, formvar, etc.). Accelerated heat aging has disclosed no effect on commercially available magnet wire at temperatures ranging from 180°C — 280°C.

SUPERIOR HEAT LIFE

10,000 hours, 155°C 50,000 hours, 130°C

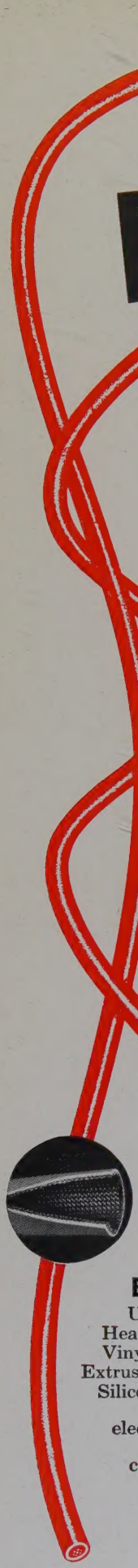
based on accelerated heat aging tests — end point: ½ of rated dielectric breakdown (ASTM D350)

UNEQUALED FLEXIBILITY

At last a resin-coated sleeving as flexible as Vinyl-glass and at comparable prices.

THERMOSETTING

Will not soften, flow, or blister as a result of "Hot Spot Temperatures". Cross-linked for form stability under most critical operating conditions.



BH FIRSTS

Use of fiberglass
Heat-treated fiberglass
Vinyl-coated fiberglass
Extrusion coated fiberglass
Silicone rubber coatings
Continuous electronic inspection
Acrylic-resin coated fiberglass

BENTLEY-HARRIS MANUFACTURING CO.
300 BARCLAY STREET — CONSHOHOCKEN 6, PA.
Telephone: TAylor 8-7600 — *A SUBSIDIARY OF RAYCHEM*

Print Ins. 1 on Reader Service Card

Print Ins. 2 on Reader Service Car

A COST REDUCTION PLAN FOR INSULATION USERS

If you are troubled with domestic or foreign competition that is creating pressure for lower prices, let Prehler investigate your product to determine how your electrical insulation costs might be reduced with no sacrifice of product performance. The answer might lie in substitute materials which do not affect quality, or less costly production techniques, or a combination of radically new materials, designs, and manufacturing methods. Prehler men have the experience and know-how required to analyze your specific problem. They are backed up with supplies of nearly every conceivable insulation material so that they can make recommendations without bias. Let a Prehler expert discuss the cost reduction possibilities of your product . . . phone your nearest office today.

PREHLER ELECTRICAL INSULATION CO.

Chicago 39, Ill., 2300 N. Kilbourn Ave., EVerglade 4-6100

Branch Offices

Cleveland 30, Ohio, 12200 Brookpark Rd., CLearwater 1-1800

Detroit 2, Mich., 411 Piquette Ave., TRinity 5-4020

St. Paul 1, Minn., 367 Grove St., CApital 5-4321

Milwaukee 12, Wis., 3379 N. Green Bay Ave., FRanklin 4-3100

Dayton, Ohio, BAldwin 2-0574

(Use Cleveland Address)

Cut costly assembly time with Fabricated Inmanco® Electrical Insulation Parts

Many manufacturers of electrical equipment are cutting costly assembly time by using INMANCO completely fabricated electrical insulation parts. INMANCO parts slip into place easily because specialized fabricating experience insures accurately fabricated insulators. This is made possible by INMANCO's modern, high-speed equipment designed to shear, saw, slit, die-cut, crease, mill, form, or cuff exactly as you specify.

Selecting the *exact* properties and materials required for your application is so easy with INMANCO fabricated parts. That is because these parts can be made from a variety of different types and grades of papers, plastic films, varnished or coated fabrics, wood, fibre, and laminated plastics—to name a few—each with unique characteristics. You can choose extreme heat resistance, top dielectric strength, maximum flexibility, toughness, or other protective features your insulation must provide.

Contact your nearest IMC office or representative for more information on fully fabricated electrical insulation parts that save time and cut cost.

Made by Inmanco® DIVISION

INSULATION MANUFACTURERS CORPORATION
565 West Washington Boulevard, Chicago 6, Illinois
Branch Offices, Representatives, and Distributors in Principal Cities

Print Ins. 3 on Reader Service Card

Insulation

For the Electrical and Electronic Industries

Lake Publishing Corporation, 311 East Park Avenue, Libertyville, Illinois, March 1961
Publishers of Insulation, Insulation Directory/Encyclopedia Issue, Plastics Design & Processing

Circulation Policy and Subscriptions: Insulation is distributed without charge within the United States to qualified users of electrical and electronic insulating materials engaged in design and specifying work covering the use of insulation. Subscription rates to others within the United States, Canada, and U.S. Possessions are $1.25 per copy, $12.50 per year, and $20.00 for two years. Rates for other countries are $25.00 per year, $45.00 for two years. Circulation requests and inquiries should give title or department, company name, and products or services of company. Corrections should also show old company name and address.
Back Issues, when available, are charged for at the rate of $1.50 per copy for 1 to 10 copies, $1.25 per copy for 10 or more copies.

Insulation, March, 1961, Volume 7, Number 3. Published monthly, except twice a month in May, by Lake Publishing Corp.,

Box 270, 311 E. Park Ave., Libertyville, Ill. Phone EMpire 2-8711. Accepted as controlled circulation publication at Mount Morris, Illinois.

BPA Member Business Publication Audit of Circulation, Inc.

Advertising Sales Offices: See page 88.

From the Editor

Opinions and Rambling Thoughts

Progress for the Insulation Conference

For those who can recall the small beginnings of the Annual Conference on the Application of Electrical Insulation, it is heartening to notice the monumental progress which has been made and which lies ahead. Dedication, heated discussions, never-ending work, and the forgetting of differences to work for the common goal, among other things, marked the beginning of the first conference in 1958. Each conference has surpassed the preceding one, both from the standpoint of technical program excellence and commercial success. Those who have contributed so much in the past deserve the highest possible praise. But the past is now dead and support is now needed for an exceptionally well planned program that lies ahead.

Improvements or worthwhile new projects are planned in a number of areas. This report is intended to bring you up to date on the conference so that you will be fully aware of what is going on, what is planned, and areas of activity in which you might be interested in lending assistance.

The next conference will be held the week of February 18, 1962, at the Shoreham Hotel, Washington, D.C. Availability, planning conveniences, and adequate space for both meetings and exhibits were prime reasons for choosing this site. These advantages far outweigh the disadvantage of Washington being an inconvenient location for a minority of those who would attend the conference. A better time element will permit the selection of more convenient locations for future conferences.

The conference name has been changed to *Electrical Insulation Conference* to make it simpler to use and to gain the benefit of easier recognition. However, the conference will still emphasize materials and applications, as in the past.

General conference chairman Roger B. White, the Glastic Corp., Cleveland, has established the theme, "Greater National Strength Through Faster Progress in Electrical Insulation," which keynotes the important role played by electrical insulation in the national and international scene. As in the past, continual efforts will be made to improve the technical program, banquet arrangements, promotional efforts, and exhibits, according to White. He has also outlined plans for new educational sessions, increased attendance by educators and technical management personnel, and more emphasis on electronics subjects without decreasing the emphasis on rotating equipment, transformers, switchgear, wire, cable, controls, etc.

Vice chairman—commercial for the 1962 conference is Arnold E. Bohn, Dow Corning Corp., Englewood Cliffs, N.J. E. L. Brancato, U.S. Naval Research Laboratory, Washington, D.C., is vice chairman—technical. Chairman of local arrangements will be H. P. Walker, Bureau of Ships, Navy Department, Washington, D.C. Charles O. Newlin, Continental-Illinois National Bank and Trust Co. of Chicago, will again serve as conference treasurer.

Under the direction of program chairman J. S. Hurley, General Electric Co., Waterford, N.Y., a technical program is already beginning to take shape. A detailed schedule for technical papers has been established and many committee appointments have been made. Plans call for careful evaluation of all papers submitted as well as extensive editing where necessary.

The commercial exhibits committee under the direction of W. J. Dwyer, Suflex Corp., Woodside, N.Y., has already started to function—more than half the exhibit spaces have been sold although contracts have not yet been prepared and space is expected to soon be at a premium.

The promotion and publicity committee has made plans for extensive, regular promotional efforts. The committee is headed by Robert Bloor, Dow Corning Corp., Midland, Mich., assisted by Frank Osterland, Allis-Chalmers Mfg. Co., Milwaukee.

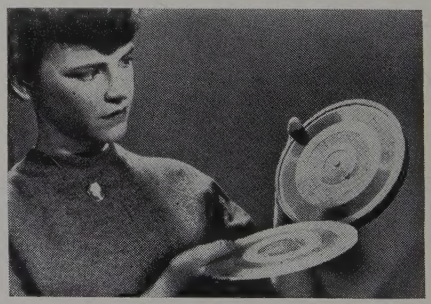
The banquet committee under W. F. Hugger, Electro-Technical Products Div., Sun Chemical Corp., Nutley, N. J., is developing new concepts and formats for the banquet. Arrangements are being made for a news-making speaker and other high-interest and entertaining features.

W. G. Hoffer, Johns-Manville Corp., New York, and 1960 general conference chairman, will head up a new awards committee. This committee will investigate the possibility of giving recognition to engineers and scientists presenting papers at the conference through technical awards to those individuals presenting the best papers.

Another newly formed committee is the Education Committee which will be headed by a well known educator. This committee is designed to stimulate the educators to contribute to the technology and in turn to promote better education in the science of dielectrics, and to raise the prestige of the engineering profession. This committee will investigate the possibilty of the conference granting a scholarship.

Silicone Rubber Record Mold

We note that the Silicone Products Department of General Electric Co. has demonstrated the high degree of model detail available with the new room temperature vulcanizing liquid silicone rubbers by using the material for molding a phonograph record. We hope that this does not mean that G-E is using its prestige and rubber in an attempt to revive the bouncy music of the Presley era.



News and Views

Bouncing Plastic Prices

The last few months have seen a price pattern in the plastics materials area similar to the gyrations of a bouncing ball. The picture is actually a reflection of the highly competitive price situation. On polystyrene, Foster Grant originally led the field by announcing a price cut to 19¢ per pound. Then the war started and prices hit a low of 17¼¢. Dow Chemical then tried to lead the way back to the 19¢ price but had to settle for 18¢ when other producers did not go along with the increase.

On conventional polyethylene, price cuts originated in Europe (where the price went down to a little bit better than 25½¢). The price in this country has been 27½¢ per pound since last August. DuPont had announced a boost to 30¢ effective in February but Union Carbide declined to go along and is maintaining the 27½¢ price, stating that the lower figure offers the best opportunity for improved growth and profits. Before August, the price had been 32½¢. Because of taxes and import duties, foreign polyethylene resins are not a factor in the United States . . . but of course, the United States and European producers are competing in other world markets.

Also in the price news is a reduction by DuPont in the price of both "Teflon" fluorocarbon resins and film. The reductions range from 35¢ to $2 per pound with the price of the basic TFE resin, which once sold for $18 per pound, now standing at $3.25 per pound. The FEP material is down to $9.60 per pound in truckload lots. Prices of the FEP film have been cut $2 per pound to $13 for films two mils or more thick, $14.50 for one mil film, and $18 for half-mil film.

And one final price note . . . Commercial Resins Corp. has announced a 15% price reduction for general purpose polyester resins. This is a 5¢ per pound reduction—bulk quantities of orthophthalic resins become 26¢ per pound and isophthalic resins become 27¢.

More Polyolefin Production

Dow Chemical Co., which just completed a polyethylene plant at Plaquemine, La., has announced plans for a second plant at that location capable of producing medium and high density polyethylene and polypropylene. Construction is scheduled to be completed in 1962. Dow's Torrance, Calif., polypropylene plant should go on stream within the next month.

Hercules Powder Co. also has disclosed that it is starting construction of a second multimillion-dollar polyolefins unit at Lake Charles, La., doubling the size of the present plant which has just started production. The new facility will bring total Hercules capacity for linear polyethylene and polypropylene to 200-million pounds per year.

And the Plastics division of Monsanto Chemical Co., not to be outdone, has announced plans for a 30 percent increase in the capacity of its high pressure polyethylene plant at Texas City, Texas. Completion is scheduled for 1962.

Class H Phenolic-Glass Laminate

The Micarta division of Westinghouse Electric Corp. has announced commercial availability of a new glass fabric reinforced phenolic laminate that reportedly compares favorably in heat resistance with silicone laminates. Properties of the relatively low cost material are said to include higher flexural strength than the silicone product, as well as stability against thermal shock, high strength to weight ratio, low thermal conductivity, and high percentage of strength retained for more than 300 hours at temperatures to 500°F. Applications include wedges, structural parts, slip rings, arc chutes, panel boards, and class H insulation.

Microwave Unit Cures Plastics, Resins, and Varnishes in Seconds

According to the Induction Heating Corp., the firm's new Ther-Monic Radar-Oven can be used to cure plastics, varnishes, resins, coatings, etc., in just a matter of seconds. One automotive manufacturer reportedly is using the new unit to cure the plastic filling in spark coils in

seconds compared to the several hours previously required. Another manufacturer is said to cure plastic moldings by microwaves and to also completely cure epoxy discs 5 inches in diameter and 2½ inches thick in just 90 seconds. The dielectric heating unit takes 25 by 25 inches of floor space and is 51 inches high. Power input to the microwave unit is 4.4 kw, three phase, 220 volt, 60 cycle a-c. Output frequency is 2450 megacycles. Weight is 317 lbs.

HOW TEAMWORK RESULTED IN 5 BIG BENEFITS FOR WIRE AND CABLE USERS

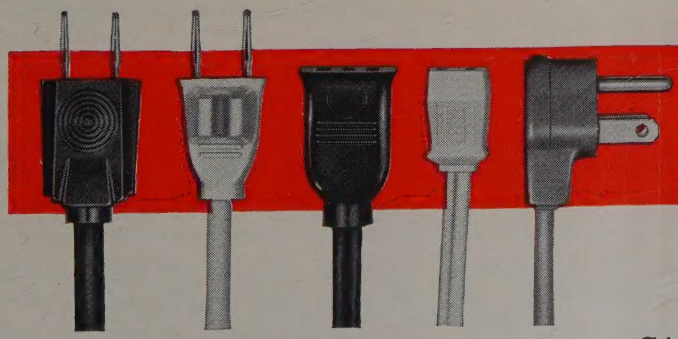
- Color Matching
- Consistency of Repeat Orders
- Plug Matches Cord
- Speed of Development
- Elimination of Flow Marks

Carol Cable Co., Pawtucket, R. I., leading wire and cable manufacturer, approached The Blane Corporation with a problem regarding exact color matching for its cord set materials.

Carol specified that the color match must be absolutely identical despite the fact that the cord is extruded and the plug molded. Carol also wanted assurances that the exacting color match would be maintained on all repeat orders.

Working in cooperation with Carol Engineers, Blane's Color Specialists produced a series of custom colored molding and extrusion compounds. These smooth appearing compounds provided identical color matching which is maintained on all repeat orders. The molding compounds have no flow marks and are streak free. The extrusion compounds provide easy processing and good overall physical properties. Blane's speed of development has also helped Carol to honor its delivery commitments and maintain Carol's fine reputation for quality products and unmatched personal service.

This is another example of Teamwork and industry leadership in action. If you have a problem in the areas of special colors, custom compounds for special requirements, or would like to discuss long term insulation problems or developments, we extend an invitation to contact us. The Blane Man will be pleased to be of service.



Carol®

CAROL CABLE COMPANY, PAWTUCKET, RHODE ISLAND

Blane

THE BLANE CORPORATION

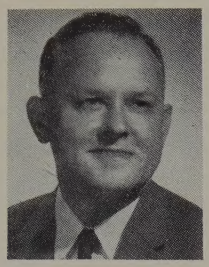
CANTON, MASSACHUSETTS

Print Ins. 5 on Reader Service Card

Insulation Forum

This regular monthly feature is built around a timely question concerning the electrical insulation field. Your suggestions for future questions and participation are invited. This month's question is:

What good things about the Third National Conference on the Application of Electrical Insulation would you like to see repeated and what improvements would you like to see made in the next conference?



Otis D. Black

Materials Standards, Radio Corp. of America, Camden, N.J.

"In agreement with most others, I thought the last conference was the best yet. The exhibits were particularly good and many of us found a great deal of help there. I would like to see that part of the conference continue to be extended and improved.

"The sessions were most informative. One suggestion that I might submit would be to have more of the sessions integrated within themselves, if possible. By this I mean that the keynote speaker should outline a specific problem area and then the program speakers would each tell what his company has to offer in the solution of that problem. This would give several angles of attack on specific problems which are bothering the industries using insulation and might be of greater help than almost random papers on a relatively general topic."

D. E. Stafford

Chief Engineer, National Electric Coil, Division of McGraw-Edison Co., Columbus, Ohio.

"We were all very well pleased with the arrangement of papers and sessions at the last insulation conference. We were very favorably impressed by the planning of the program. We especially liked the planning which arranged the different sessions so that those interested in basic chemistry and composition of insulation materials found papers of interest, as well as those who were interested in specific applications to electric equipment and machinery. We would like to see the same arrangement continued at future sessions."

H. W. Dornbush

Chief Design Distribution Engineer, Pennsylvania Transformer Div., McGraw-Edison Co., Canonsburg, Pa.

"The 3rd Conference again provided those attending an opportunity to hear papers and discussions on a wide variety of insulation materials and application problems. In addition, a wealth of the latest information was available from the exhibitors, who ranged from materials suppliers through component manufacturers to those who make test equipment. Many of the top technical personnel from insulation manufacturers were available for consultation concerning the use and characteristics of their materials. These things make the conference successful.

"Having attended all three conferences, I see a pattern of repetition, with papers being presented which overlap in subject matter with previous papers. I feel that for the continued success of this conference, the technical content of the papers must be increased. If top technical personnel of insulation users are to be attracted, papers must be on a level of technical information to attract them and tell them something new and useful in their product."

E. W. Summers

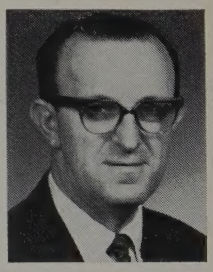
Supervisor, Motor Insulation Development, Motor and Control Div., Westinghouse Electric Corp., Buffalo, N.Y.

"Each succeeding year the organization of the conference has improved and this year it was excellent. With respect to the technical program, I feel that the system of having a director and a manager for each session with the director writing a keynote paper should be retained. Furthermore, the policy of controlling the length of time allocated to each paper so that a strict schedule can be maintained to facilitate 'session hopping' is desirable.

"However, the innovation at the last conference of presenting an End User paper achieved only limited success. Some of the sessions did not have such a paper, indicating that they were difficult to arrange. The value of these papers to the conference should be evaluated to determine if they achieved their intended goals.

"Unfortunately, the impression many observers get is that the technical program is aimed at quantity rather than quality. It is likely that a shorter program with high quality papers would be more satisfactory.

"Although this may be heresy, I feel that there are too many luncheons and banquets and that at most of them the activities dwell on platitudes. It would appear that one good banquet at a reasonable price should be sufficient."



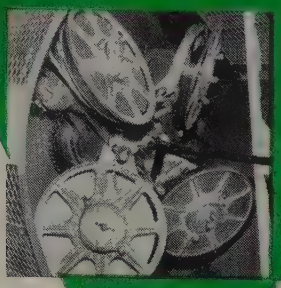
L. Mayeron

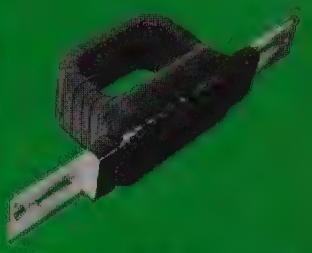
Chief of Components and Materials, Engineering Dept., Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

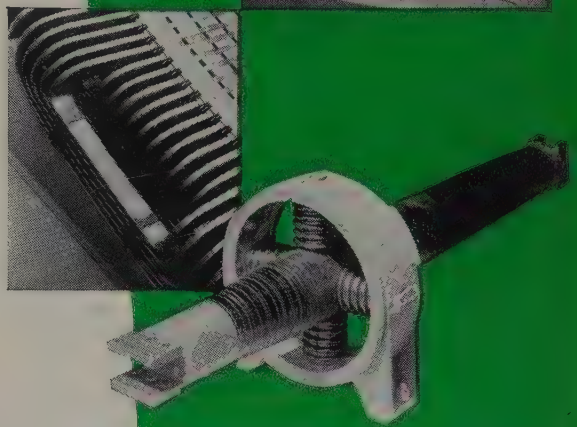
"This was the first of the conferences that I have attended, therefore I cannot compare it to the previous ones. I feel, however, that the technical portion of the program was very well planned and executed. Having a consumer, as a session director, take an active part in planning the technical program is, I believe, an excel-

Natvar TERAGLAS®

A NEW CLASS B INSULATION HAS RESILIENT WEAVE AND HIGH DIELECTRIC STRENGTH UNDER STRETCH







Natvar Teraglas is a new flexible insulating material comprising a base fabric, woven from polyester (polyethylene terephthalate, or "Dacron") warp yarns and continuous filament glass filler yarns, coated with an improved varnish, possessing exceptional dielectric strength under elongation. It will withstand Class B (130°C) operating temperatures.

In view of the higher dielectric strength of Natvar Teraglas compared to bias varnished cambric, thinner sections or fewer layers may be used to provide the voltage breakdown protection desired. Consequently, at comparable tape prices, a significant saving may be realized in production costs, while permitting up-grading to Class B (130°C) temperatures.

Natvar Teraglas is available in .008", .010", .012" and .015" thicknesses—in tapes, in full width rolls (36"), or in sheets. Ask for Data Sheet and Samples.

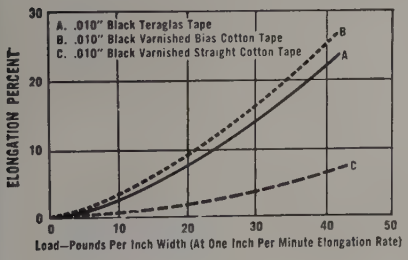
Natvar Teraglas will prove advantageous in many applications — for insulating motors, generators, transformers, cables, switchgear, busbars, and other apparatus and equipment where resiliency and high dielectric strength are desirable.

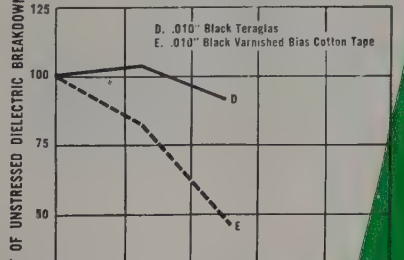
TYPICAL DATA

Physical Properties:		.008"	.010"	.012"	.015"
Approx. weight lbs./sq. yd.		0.43	0.54	0.62	0.77
Breaking Strength lbs./in. width	Warp	45	45	45	45
	Filler	100	100	100	100
Tear Strength, grams	Warp	1000+	1000+	1000+	1000+
	Filler	1000+	1000+	1000+	1000+
Elongation, % (Under 25 lbs./in. width —3 minutes)		9.5	7.5	7.5	7.0

Electrical Properties:	.008"	.010"	.012"	.015"
Elec. Breakdown Strength (C48-23-50 V/M)	1600	1600	1600	1600
Elec. Breakdown Strength (Under 6% stretch)	1600	1600	1600	1500
Elec. Breakdown Strength (Under 12% stretch)	1500	1450	1450	1300
Power Factor, %, at 80° C-50 V/M-60 c.p.s.	2.2	2.5	2.5	3.0

LOAD-ELONGATION CHARACTERISTICS FOR NATVAR BLACK TERAGLAS





Natvar Products

- Varnished cambric—sheet and tape
- Varnished canvas and duck—sheet and tape
- Varnished silk and special rayon—sheet and tape
- Varnished papers—rope and kraft—sheet and tape
- Varnished, silicone varnished and silicone rubber coated Fiberglas*—sheet and tape
- Slot cell combinations, Aboglas®
- Teraglas®
- Isoglas® sheet and tape
- Isolastane® sheet, tape, tubing and sleeving
- Vinyl coated and silicone rubber coated Fiberglas tubing and sleeving
- Extruded vinyl tubing and tape
- Styroflex® flexible polystyrene tape
- Extruded identification markers

*TM (Reg. U.S. Pat. Off.) OCF Corp.

We will be very happy to supply information on any of our products on request.

NATVAR CORPORATION

FORMERLY THE NATIONAL VARNISHED PRODUCTS CORPORATION

Telephone	TWX	Cable Address
FULTON 8-8800	RAHWAY, N.J., RAH 1134	NATVAR: RAHWAY, N.J.

239 RANDOLPH AVENUE • WOODBRIDGE, NEW JERSEY

Print Ins. 63 on Reader Service Card

lent way to bring the consumer's interests, problems, etc., into the lime-light.

"I like the idea of the exhibits, and I thought the exhibition floor was very well planned.

"My main suggestion for improvement would be to increase the attendance of consumers. This I feel can be done with additional publicity by each exhibitor. At least two months before the conference each exhibitor should have available literature on this conference which he can mail directly to his customers. I know this is done with some of the other engineering conferences and they have an excellent attendance of consumers."

New Subscription Rates

We regret that, due to increased costs, we have been forced to raise the subscription rates for *Insulation* for those subscriptions requiring payment. Effective immediately, the new rates are $12.50 for 1 year and $20.00 for 2 years in the U.S. and Canada; $25.00 for 1 year and $45.00 for other countries.

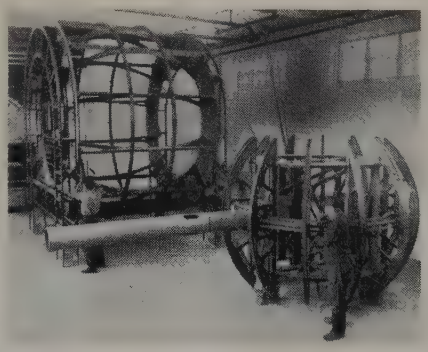
Dielectric Structure For VLF Transmitter

Large non-metallic structures for the world's most powerful VLF (very low frequency) radio transmitter are being manufactured by Permali, Inc.

The station, now under construction for the U. S. Navy near Cutler, Maine, will operate on a frequency of 14 to 30 kilocycles, beaming out radio waves over six miles in length, which can be received by surface ships and shore stations around the world. Of unique importance will be the station's ability to communicate with submerged submarines. To receive messages now, remotely located submarines must send an antenna-bearing periscope above the surface, thus risking detection.

The structures being built by Permali are made from a laminated plastic produced from carefully selected thin wood veneers which are impregnated under vacuum with a special synthetic resin and densified by the application of heat and pressure. The structures serve as dielectric supports for two variometers and a like number of helix coils. They are assembled with nuts, bolts, and dowels made from the same non-metallic material.

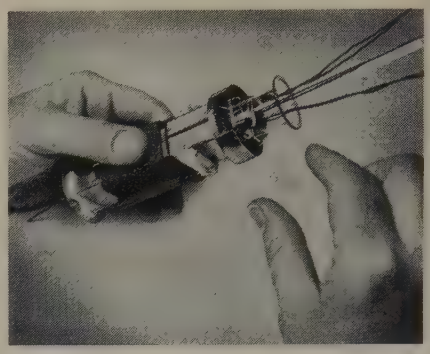
Each variometer consists of a rotor (right) and a stator (left) to provide



variable inductance for circuit tuning. Each of the two tuners will measure 21½ ft. high, 13 ft. long, and 12 ft. wide. The rotor, supported by a specially designed tube of approximately 12-in. diameter, and enclosed by the stator structure, will carry approximately 4,000 lbs. of 3.4-in. cable, and is so designed that the angular distortion during operation will not exceed 10 minutes of angle. The stator, likewise will be wound with 3.4-in. cable weighing some 5,000 lbs.

Mica 'Gripper' In Power Tube

A thin sheet of natural mica is now used as an "anti-slip" medium in an electron power tube to aid in maintaining critical assembly alignment. Barely 0.003″ thick, the stamped mica part is used by RCA in small power



tubes as an insert between a metal clamp and a cylindrical glass stem. The metal clamp is the bottom support for the mount assembly.

Inserted between the metal and glass, the natural mica provides a firm "grab" on glass, prevents movement of parts, and protects the glass stem against damage from clamp pressure. Resilient enough to be wrapped around ¾″ diam. stem, the natural mica retains its properties under tube operating temperatures and does not contaminate tube atmosphere or components.

Each tube uses a mica "gripper" 9/16″ wide and 2″ long. Pieces are production-punched to 0.005″ tolerances from clear Indian ruby mica by Ford Radio & Mica Corp., Brooklyn, N.Y.

Alloys for Low Temperature Bonding

The National Bureau of Standards has developed gallium alloys for the low-temperature bonding of wires to heat-sensitive electronic devices. These alloys, which are soft when mixed at room temperature, resist temperatures up to 900°C after hardening. It was also found that they could be used to "cold solder" certain ceramic and metallic surfaces.

now! bond strength flexibility thermal life

with

DOLPH HI-THERM® BC-340 CLASS F INSULATING VARNISH

Dolph meets the need! Hi-Therm BC-340 is another Dolph first. It meets the electrical industry's requirement for an **all-purpose** Class "F" clear baking varnish . . . combining the **bond strength** necessary for rotating equipment, the **flexibility** needed for form coils and transformer windings and the **thermal life** required for the full range of electrical applications.

Hi-Therm BC-340 has been extensively field tested as a motor varnish, a transformer impregnant and a form coil varnish. It has proved an outstanding addition to Dolph's line of high quality insulating products. Use this general purpose impregnant and coating in any of the conventional treatment systems. It cures to a hard, tough, flexible film that is tack free and mar resistant, retaining its exceptional qualities at operating temperatures up to 155°C. Get the complete story on this versatile, all-purpose varnish immediately. Write us today.

Meets and surpasses MIL-V-1137A

• Excellent chemical resistance • Excellent fresh and salt water resistance • High resistance to oils • High gloss • Superior adhesion • Excellent hardness • Uses conventional curing methods • High dielectric strength

LICENSEES:
IN ENGLAND: The Walpamur Co Ltd., Darwen, Lancashire, England
IN ITALY: Societa Albesiano, Moncalieri (Torino) Italy
IN CANADA: Crown Diamond Paint Co. Ltd., Montreal, Canada

Dolph's®

JOHN C. DOLPH COMPANY

Insulating Varnish Specialists • Monmouth Junction, New Jersey

Print Ins. 7 on Reader Service Card

European Insulation Report

Ed. Note: *The author of this monthly European report is a well-known insulation expert associated with a large European electrical manufacturer. Although it is necessary that his identity not be revealed at this time, correspondence may be exchanged with him by writing* European Editor, Insulation, Box 270, Libertyville, Illinois.

The extracts of articles about epoxy resin casting technology given in the previous issue of *Insulation* and the description of their applications could be carried on further without anything new being said.

However, I would like to give an extract of an extensive article before I discontinue this subject because the ideas in this article have to be regarded as very original. One cannot simply dismiss these ideas as utopian in view of the fact that the author's firm itself and a few other reputable firms have adopted a large part of these ideas for their production lines. How far one could realize these very interesting ideas regarding encapsulated high voltage equipment and how far they will succed is still undecided.

The author of this article is the director of a small firm for electrical equipment, Moser-Glaser & Co. A. G., in Muttenz near Basel, Switzerland. The firm makes special transformers, current and voltage transformers embedded in synthetic resin, to the highest voltages, etc. The ideas given in this article have already been published at different times, but not in such a concentrated form as in the following article:

About New Conceptions and Materials in High Voltage Technology, by A. Imhof in the Schweizerische technische Zeitschrift No. 6, February 1958, pp. 93-120. Original title: Ueber neue Konzeptionen und Werkstoffe der Hochspannungstechnik.

In the first part of the article, a revolutionary proposal for a dry-type construction of hv and ehv switchgear is made. As far as the European Editor is informed, no large equipments have been manufactured in this way until now. Of course, they should now be in an advanced stage of development.

It is proposed to embed each phase individually with all necessary apparatus in a metallic sheet casing. The individual parts are cast separately. A coupling-joint occurs when assembling the individual apparatus with each other to form a complete cast. This is, naturally, a critical part and, according to Imhof, should have such a form that the tangential field strength at every point is constant. The gap in the coupling-joint is kept very narrow and is filled with a gaseous or liquid insulation material. Figure 1 shows a diagram of a coupling-joint. The author gave thought to the appearance and shape of the

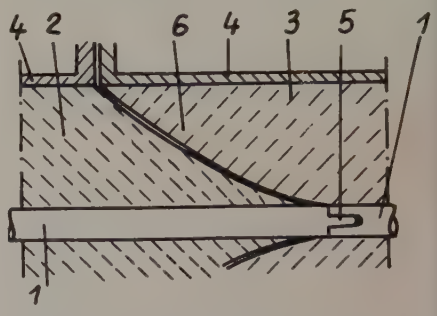


Figure 1, principal diagram of a coupling-joint: 1) conductor, 2 & 3) epoxy resin, 4) metallic casting, 5) tulip contact, and 6) coupling-joint.

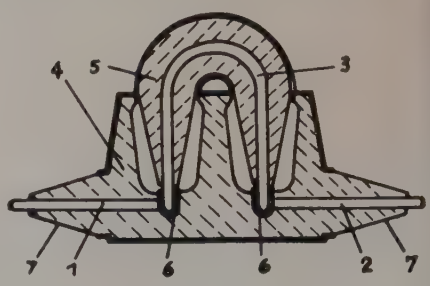
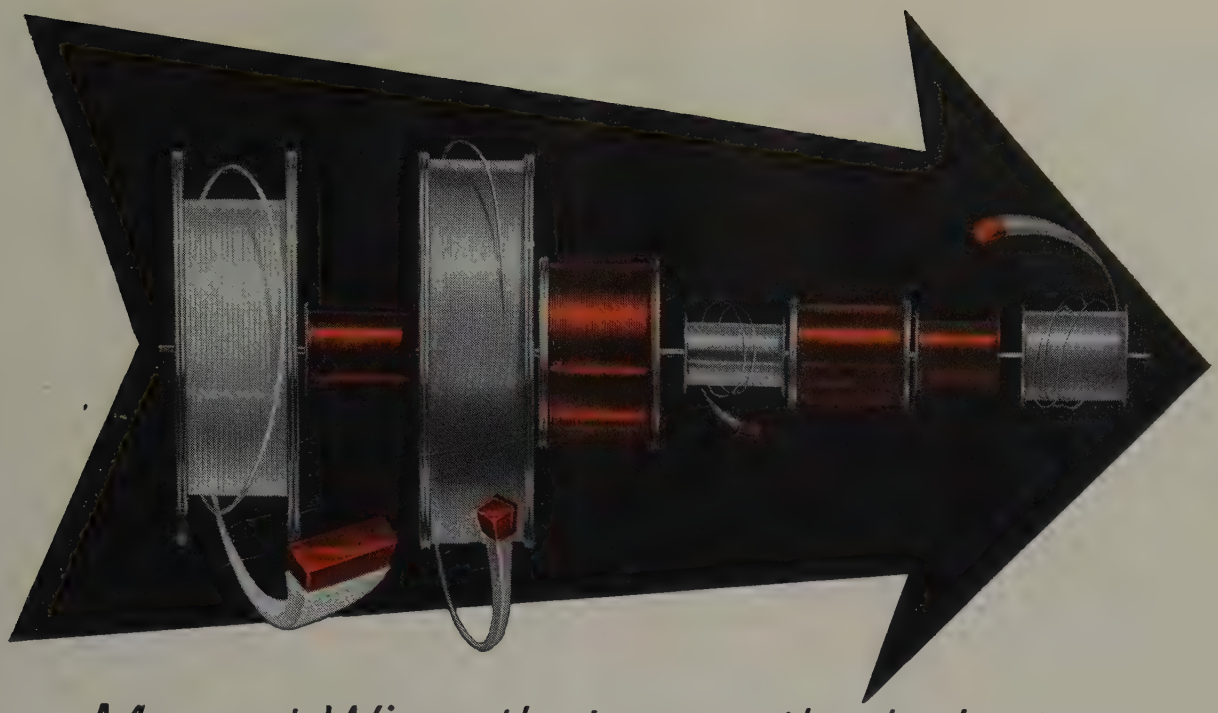


Figure 2, disconnecting switch: 1 & 2) the high voltage conductors to be disconnected, 3) connecting ring, 4) the insulation for the immovable parts, 5) the insulation for the connecting ring, 6) contacts, and 7) coupling cones.



Magnet Wires that pace the Industry come from Phelps Dodge!

Phelps Dodge Applied Research has developed many outstanding magnet wires that anticipate the requirements for advanced insulation system designs. This widely diversified group of Phelps Dodge "firsts" includes:

CLASS A (105° C) to CLASS F (155° C)

POLY-THERMALEZE® (multi-purpose film)

SODEREZE® (solderable); **FORMVAR*** (square and rectangular);

BONDEZE® (self-bonding); **GRIP-EZE®** (solderable self-gripping);

CLASS A (105° C)

S-Y BONDEZE® (solderable self-bonding);

HERMETEZE® (for hermetic motors);

SODEREZE-BONDEZE® (solderable self-bonding).

CLASS B (130° C)

NYLEZE® (solderable)

CLASS F (155° C)

DAGLAS® (flexible glass)

CLASS H

DAGLAS H® (flexible glass)

The complete line of Phelps Dodge magnet wires also includes: ML (Class H *plus* film); Enamel; Formvar* (round); Epoxy; Nyform; Paper, Cotton; Multiple Combinations.

*FORMVAR®—SHAWINIGAN RESINS

Any time magnet wire is your problem, consult Phelps Dodge for the quickest, surest answer!

PHELPS DODGE COPPER PRODUCTS
CORPORATION
INCA MANUFACTURING DIVISION, FORT WAYNE, INDIANA
FIRST FOR LASTING QUALITY—FROM MINE TO MARKET
Visit Our Booth 4028-9, I. R. E. Show
Print Ins. 9 on Reader Service Card

PD

individual parts. Busbars, bushings, and measuring transformers apparently present no difficulties.

How a disconnecting switch would look can be seen in figure 2. Solutions for the embedment of switches and lightning conductors are also proposed but these have not yet been thoroughly constructed.

The advantages of such a cast apparatus specified by the author are incontestable. They are:

Possibility of assembling any desired circuit out of individual elements. Space saving in the order 1:2 to 1:6.

Not flammable.

Can be made for all voltages indoors or outdoors. (The author believes that these proposals can be carried out to the highest voltages!)

In the second part of the article, the author describes the technique of Moser & Glaser Co. for manufacturing high-quality, low oil content to dry insulation. With large objects, such as 150-380 kv voltage transformers, it is very risky to cast the whole part with a thermosetting resin because of the difficulties connected with the contraction of the resin during polymerization. In order to avoid the disadvantages of the usual oil-paper insulation and to obtain a mechanically strong cover for protection against humidity, the insulation of paper impregnated with oil is recast directly with synthetic resin. This system has the name "Epolpa."

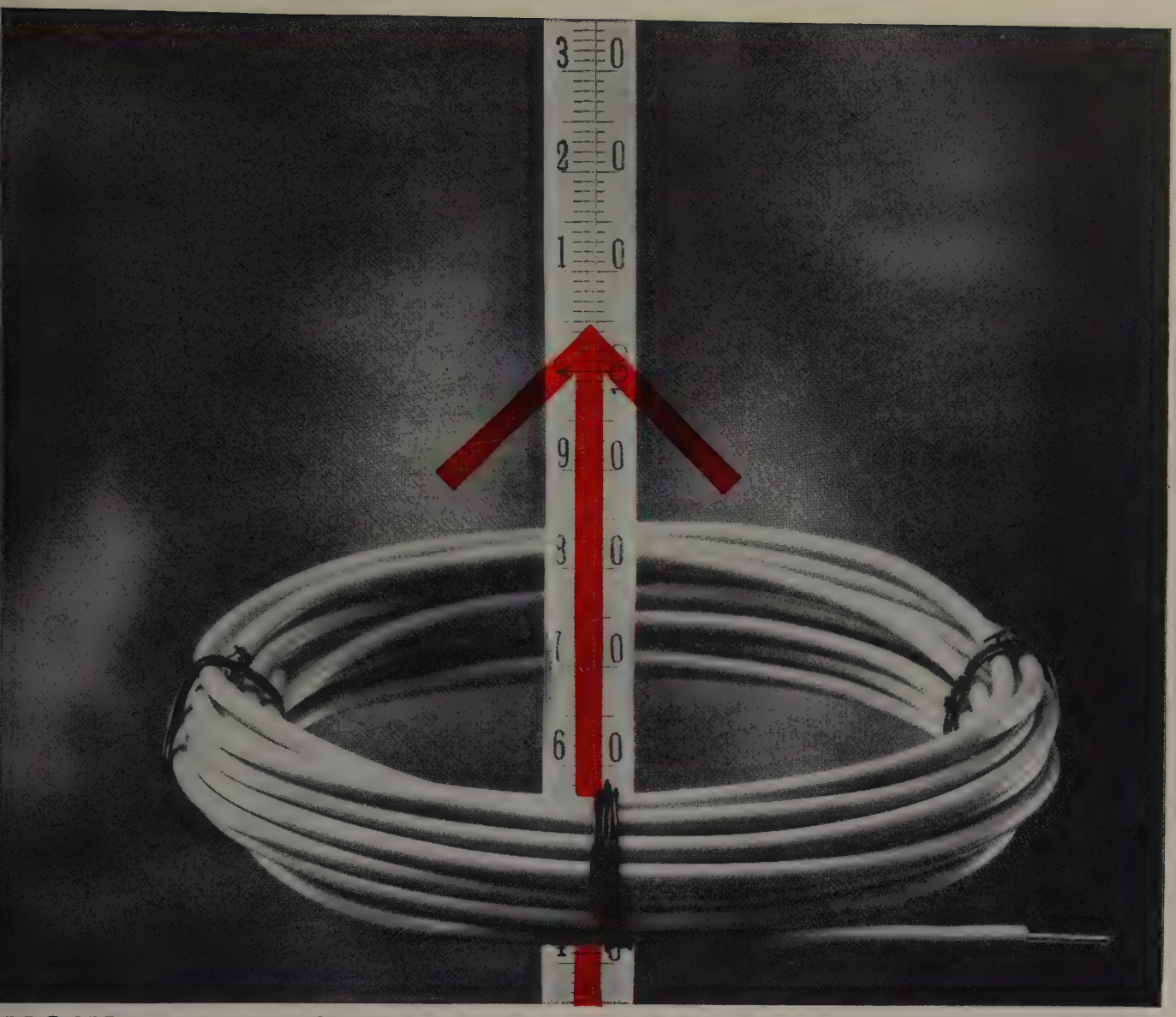
Further development led to a completely dry insulation. This process has, in contrast to casting, the advantage that no molds are necessary and coils as well as busbars of considerable lengths can be insulated. The construction of control-layers is also easily possible especially because the insulation is void-free and therefore there is no possibility of corona discharges at the edges of the control-layers. It is also easy to work with this insulation. The significant properties of this insulation lead the author to the conviction that the epoch of mica insulation of coils is coming to an end.

Detailed accounts about the applications and properties of these materials are given. Even if most of the proposals are of interest to the production engineer, they also should stimulate the insulation engineer. It is important to determine the degree to which these technological possibilities are of decisive influence on the construction of equipments.

Different articles appeared last year about dry-type transformers. The insulating materials as well as the design hardly differ from those in the USA. These equipments are making their way very slowly because the rigorous specifications of American insurance companies are, to a great extent, absent.

The articles which give present views on this subject are among others: *Dry-Type Transformers*, by A. E. Williams, Electrical Journal (London) 17. June 1960, pp 1712-1715. Several articles in the Elin-Zeitschrift (Austria) Vol. XII, No. 2, June 1960.

The European Editor feels that it would be a waste of time to make any further comments on these articles because the reader would find US views and techniques repeated.



NOW . . . IMPROVED VOLATILITY CHARACTERISTICS IN A PLASTICIZER

New material is designed for wire insulation up to temperatures of 105° C

"Elastex" 26-P Plasticizer (Di-tridecyl Phthalate) is a new light-colored phthalate ester of keen interest to the vinyl compounder—particularly in the production of wire insulation for use at extremely high service temperatures.

The unusual combination of properties possessed by "Elastex" 26-P Plasticizer is especially useful in wire insulation and other applications—where higher service temperatures than formerly possible with many monomeric-type plasticizers are required.

Allied Chemical's recommended procedures for incorporation of "Elastex" 26-P in high temperature wire assure you of optimum working characteristics, reduced costs and elimination of more expensive materials.

The following chart indicates performance:

ACCELERATED AGING, 7 DAYS AT 136°C	UL Spec. Subject 758 Min	DDP	Polymeric	26-P
Retained Tensile Strength, %	65	250	93	108
Retained Elongation, %	65	0	98	90
Volatility, % wt. loss	—	17.1	2.2	6 0

Allied Chemical is glad to assist in improving your products with "Elastex" 26-P Plasticizer or the many other Allied Chemical Plasticizers. Call our representative or write us direct for samples and technical data.

PLASTICS DIVISION
40 RECTOR STREET, NEW YORK 6, N.Y.

Allied Chemical

Print Ins. 11 on Reader Service Card

Pixilated Patents

By Mike Rivise

(Fifty-first in a series of odd and interesting inventions in the electronics field from the files of the U.S. Patent Office.)

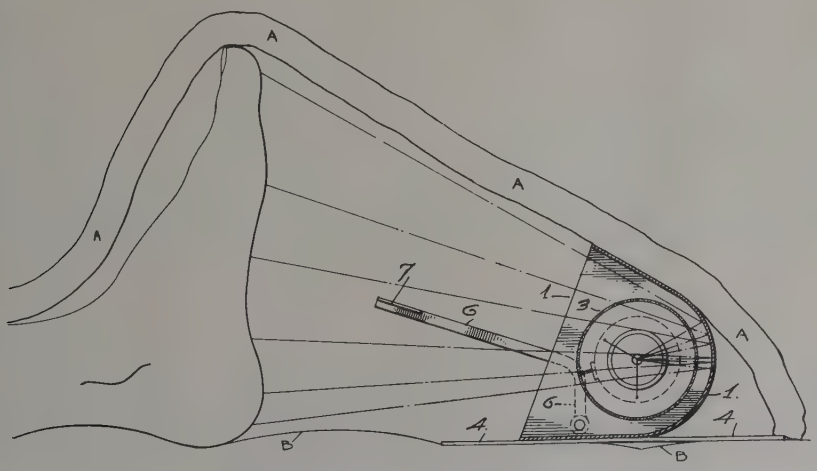
Relief for cold-footed sleepers may be provided with rediscovery of patent 1,348,506, which gives specifications for a foot-operated electrical foot-warmer. Patented by José A. Mata on August 3, 1920, it consists of an electric lamp and housing designed for use in bed. The housing reflects the heat of the lamp onto the sleeper's feet and also holds the bed clothing away from the lamp so it won't catch fire. What prevents the sleeper's feet from cooking is not specified. Presumably, most sleepers will wake up when the medium-rare stage is reached.

If this were all there were to the invention, however, millions of do-it-yourselfers would immediately say, "Aha, my trouble light and a sturdy lamp shade will do the same thing."

The unique feature of this invention is a lever and ratchet device which allows the occupant of the bed to turn the lamp on and off with his foot with a minimum of effort . . . while remaining warm and toasty under the covers.

As shown in the illustration and described in the patent, "lever 6 is pivotally mounted upon one end of the housing or shade 1 and is provided with a lateral extension 7 to provide a bearing surface whereby said lever may be operated by foot pressure. The switch operating chain 8 extends from the socket 2 and has its free end secured to the lever 6. The socket 2 is of the chain type wherein a chain is connected to an interior star or ratchet switch in which successive tensions or pulls on said chain will alternately light and extinguish the lamp 3.

"In operation the device is placed under the bed clothing A and upon the mattress B and a slight distance from the foot of the operator. . . . When sufficient warmth shall have been imparted to the feet of the operator the lateral extension 7 of the lever 6 is depressed by the foot of the operator thereby operating the switch socket 2 to extinguish the lamp 3. If the foot of the operator should again require warming the extension 7 of the lever 6 is again depressed by the foot of the operator as hereinbefore described."



Letters to the Editor

Correction

"I have received *Insulation* for December 1960. In my article ("Choice of Insulating Materials When Rewinding Motors and Generators") there is an error on page 59 under 'Corona Resistance.'

"You have printed: 'High temperatures in motor or generator windings can start corona in cavities in the insulation.' In the manuscript it was: 'By h.t. windings in motors and generators corona can start in cavities in the insulation.'

"Unfortunately I had written 'h.t.' instead of 'high tension.' High tension means high voltages."

—Erik Hox, Director, A/S Rich. Pfeiffer, Sarpsborg, Norway.

And Another

"A copy of the December issue of *Insulation,* which contains my article 'Trends in Insulating Materials and Applications, Particularly High Temperature Problems,' has just come to hand.

"It is a most pleasing presentation and it is with real regret that I have to point out an error on page 44.

"If you look at the photographs of the mouldings shown in figures 11 and 12 you will see that the information has been reversed, i.e., figure 11 is described as glass filled modified phenolic badly blistered. Actually it is glass filled alkyd which is in good condition as shown by the photograph. On the other hand, figure 12 shows a badly blistered glass filled phenolic moulding which is described as glass filled alkyd in a satisfactory condition.

"Somewhere the information on the two photographs has been changed over and I trust it is in order to bring this error to your notice."

—H. Wood, Rotax Ltd., Willesden Junction, London.

Polyester vs Epoxy Issue

"With regard to the article, 'New Developments in Epoxy Resins—Part 2' (*Insulation,* January 1961) by Lee and Neville, I believe an injustice has been done concerning unsaturated polyesters or certainly at least clarification is needed regarding 'Polyester Versus Epoxy Resins.' The term 'disbeliever' appears to be unwarranted when one considers the vast number of successful applications of unsaturated polyesters in the electrical industry.

"Potting of electrical equipment can be achieved by two methods: 1) the deep impregnation and embedment of parts, and 2) the outer protection of electrical assemblies, which is termed encapsulation. The latter category appears to be the prime issue.

"Dr. Lee points out that unsaturated polyesters have high shrinkage. It is generally accepted that unfilled epoxy shrinkage values fall in the range of 2-4%. Unsaturated polyesters have been formulated that have 4% shrinkage. Thermal stability is a nebulus term, but one screening method is based on weight loss. We have tested unfilled unsaturated polyesters which, after 1500 hours at 250°C, have shown a weight loss of 11%. 'Typical' epoxy formulations under the same conditions show weight losses above 30%. Thermal shock resistance, until recently, was determined by Mil. Spec. 16923. We have several unsaturated polyesters which have successfully passed this test and indeed have passed —70°C cycling. As to chemical resistance, all resins appear to have some limit. It is well known that epoxy resins have poor resistance to oxidizing acids while polyesters have good resistance to these acid conditions.

"I do not wish to belabor these points but only to suggest the same reasoning that Dr. Lee so carefully considered in his article. That is, 'any values reported as a range of values must be interpreted as a range for that one property only.' And it follows that an experienced formulator can achieve similar excellent results when using unsaturated polyester resins. Further, it is equally true for the electrical industry that the major-

HEAT RESISTANT RESIN-COATED GLASS CLOTH

VARTEX

POLYPOXY TP-1052

FLEXIBLE CLASS F (155°C) ELECTRICAL INSULATION

low weight loss

good mechanical properties

outstanding thermal stability

excellent compatibility

"VARTEX" TP1052 is glass cloth impregnated with a high heat resistant varnish which produces an excellent flexible insulation for operation in the Class F range of temperatures. The glass cloth imparts good mechanical properties while the varnish possesses high dielectric strength.

"VARTEX" TP1052 can be supplied on any base or thickness that fits your application.

- Inquiries are solicited.
- Agents in principal cities.

TYPICAL TEST DATA

THICKNESS	.007" ± .001"
BREAKING STRENGTH	110 LBS/INCH
WT./SQ. YD.	.43 LBS.
VOLTS PER MIL	
AS RECEIVED	1550
RETENTION AFTER 4000 HRS. @ 180°C, ⅛" BENT MAND.	103%

NEW JERSEY WOOD FINISHING COMPANY

MANUFACTURERS OF FLEXIBLE ELECTRICAL INSULATION • WOODBRIDGE, N. J.

VARNISHED CAMBRIC CLOTH AND TAPES • VARNISHED "FIBERGLAS"† CLOTH AND TAPES • VARNISHED SILK AND SILK SUBSTITUTE • SYNTHETIC RESINOUS TAPES AND EXTRUDED TUBING • POLYETHYLENE, SHEETS, TAPES AND EXTRUDED TUBING • CABLE WRAPPING TAPES • "VARSIL" SILICONE VARNISHED "FIBERGLAS"† CLOTH AND TAPES • "VARSLOT" COMBINATION SLOT INSULATION: – RAG PAPER AND VARTEX VARNISHED CAMBRIC • FISH PAPER AND VARTEX VARNISHED CAMBRIC • RAG PAPER AND "MYLAR"* POLYESTER FILM • ASBESTOS PAPER AND "MYLAR"* POLYESTER FILM • KRAFT PAPER AND "MYLAR"* POLYESTER FILM • VARTEX VARNISHED "FIBERGLAS"† AND "MYLAR"* POLYESTER FILM • SPECIAL COMBINATIONS AVAILABLE UPON REQUEST.

*Mylar, DuPont's registered trademark

†Fiberglas, Owens-Corning Fiberglas registered trademark

Print Ins. 15 on Reader Service Card

ity of successful unsaturated polyester formulations are 'not reported in the literature.'

"Unsaturated polyesters, because of their good to excellent physical properties, low cost, ease of handling, ease of manufacturing (end use), excellent electrical properties, two year pot life at 10°C, ultra-fast cure, and low toxicity, have enjoyed a place of prime importance as insulating materials in the electrical industry. There is no doubt, however, that epoxy resins will also be of prime importance to this industry. There is a place for both materials and as such their use will continue for many years to come."

—D. A. Rogers, Jr., Insulation and Chemicals Dept., Materials Laboratories, Westinghouse Electric Corp., Pittsburgh, Pa.

Lee's Reply

"Many thanks for forwarding Mr. Rogers' letter. I believe the following will answer it:

1) I believe our remarks concerning the properties of unsaturated polyester resins were correct generally, and did not constitute an unfair comparison to epoxy resins.

2) I do agree that it may be possible to synthesize an unsaturated polyester resin to have an excellent value of one certain specific property, such as Mr. Rogers outlines. However, I note that he does not claim to have an unsaturated polyester resin having the full combination of properties he outlines (low viscosity, long pot life, fast cure, low weight loss at 500°F, and high thermal shock resistance). As the reader is aware, the thesis of our articles was that the term epoxy covered a wide range of properties, and that within the class any one specific property could be improved, but usually to the detriment of other properties, and that it was only by full formulation knowhow that optimum balances could be achieved. Such is the case also for other resins such as unsaturated polyester, as Mr. Rogers' letter implies.

3) Our position that most epoxy resins are superior to most unsaturated polyester resins is hence most defensible, despite exceptions, and we apologize to Mr. Rogers if he has one special resin which stands head and shoulders above other polyesters.

4) We regularly evaluate all new polyester resins as well as epoxy (and urethane) resins offered to us commercially for use in formulating superior encapsulating compounds, and we would be pleased to evaluate any Mr. Rogers would care to submit.

5) We would like to point out that the MIL-I-16923 thermal shock test with the hex bar is generally not considered a severe thermal shock test, even to —70°C. Almost any epoxy resin can be made to pass it with a little formulation. The industry has generally gone to the Olyphant washer test (discussed in our February article, the third of the series) as being a test more representative of shocks encountered on large pieces of electrical equipment.

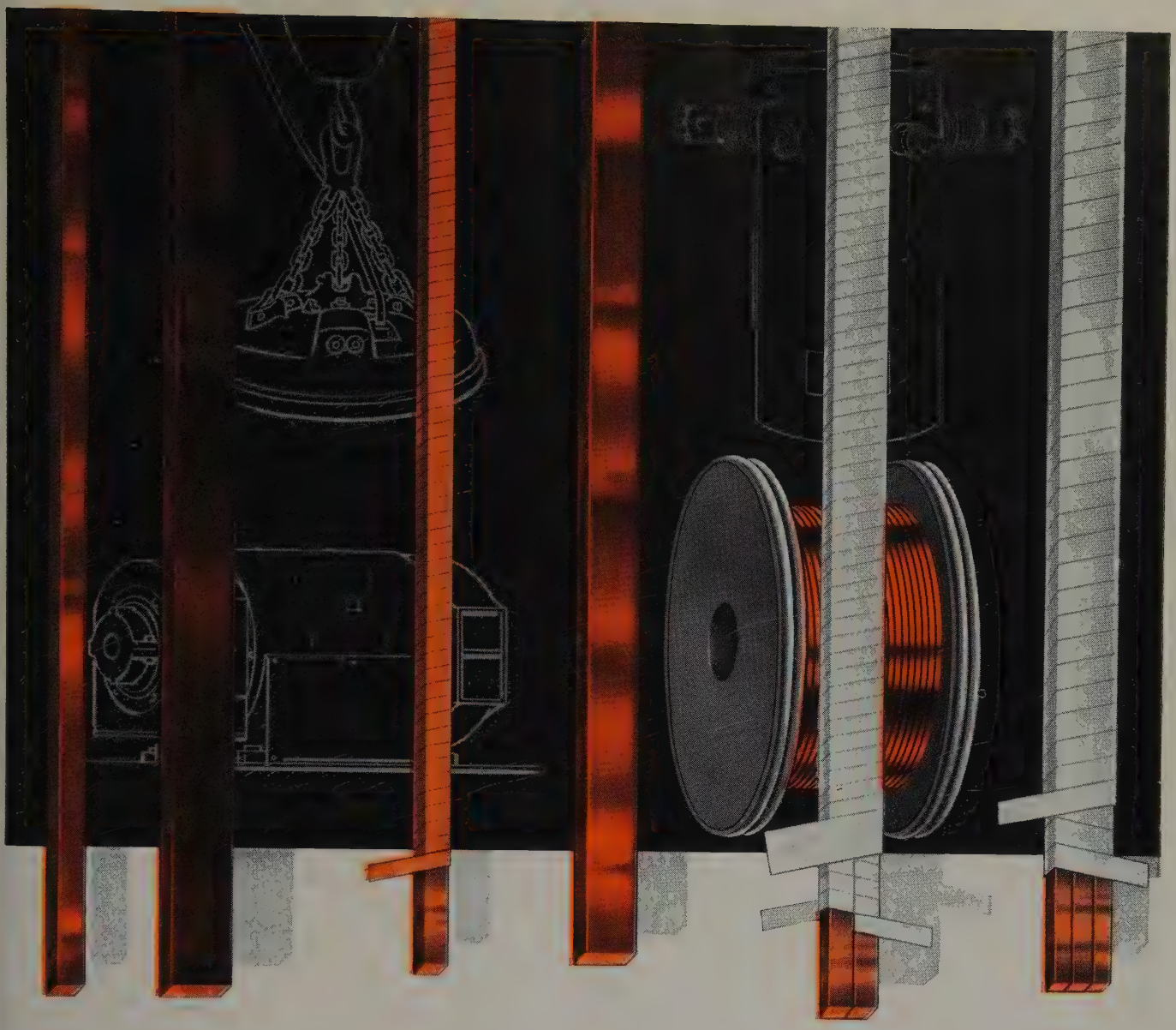
"All in all, we believe we took a conservative position in our article. We believe Mr. Rogers should be more upset by the Foreign Editor of *Insulation*, who, also in the January issue, on pages 32 and 33, had the following to say about unsaturated polyesters as a class:

'It should be noted that no electrical properties are given for the polyester mass mentioned above. In contrast to the USA, polyester resin is very seldom used for the manufacture of parts of electrical equipment in Europe. Polyester filled with glass fibers is used mainly for the manufacture of boats, tanks, etc. For high voltage electrical insulation, epoxy resins filled with quartz powder are mostly used.

'These coils are now cast directly on the pole with an epoxy resin. Extensive tests have shown that unsaturated polyester resin did not satisfy the class B temperature requirements.

'The polymerization of polyester is a highly exothermic process whereby a shrinkage of up to 12% of the volume is possible. Dangerous tension can thereby arise in the casting which can result in cracks in the material. However, this is not the case with epoxy resins.' "

—Dr. Henry Lee, Technical Director, The Epoxylite Corp., South El Monte, Calif.



Belden Square and Rectangular Magnet Wire

Delivery . . . QUICK Quality . . . CONTROLLED

Coverage . . . COMPLETE

To meet the many specialized requirements of today's transformers, large motors, electromagnets, and other electrical equipment, Belden offers a widely diversified line of square and rectangular magnet wire . . . all manufactured to the highest standards of quality. Specify with confidence.

- Formvar—105C
- Formvar, Glass Covered—130-155C
- Beldtherm*—130-155C
- Beldtherm, Glass Covered—130-155C
- Epoxy—130C
- Glass or Dacron Glass—130C
- Glass or Dacron Glass, Silicone Bonded—180C
- Multiple Cotton Covered—105C
- Paper and Cotton Combinations—105C
- Multiple Paper Covered—105C

*Belden Trademark Reg. U.S. Pat. Off.

Belden
WIREMAKER FOR INDUSTRY
SINCE 1902
CHICAGO

one wire source for everything electrical and electronic

lead wire • power supply cords • cord sets • portable cordage • electronic wire • control cables • automotive replacement wire and cable

1-4-0

Diallyl Phthalate Connector Insulators

Insulators molded of diallyl phthalate resin reportedly are being used in a new line of Crouse-Hinds Co. circuit-breaking electrical connectors

to insure high-capacity performance even after severe humidity and temperature conditioning. Successful redesign of the insulators reduced their size by one-half and contributed to a cut in weight of about 80 percent for the connectors.

Compounds based on "Dapon" diallyl phthalate, supplied by Food Machinery and Chemical Corp., were specified for the insulators because of the resin's unusual resistance to moisture and post-mold shrinkage which may cause cracking and misalignment of contacts. Use of diallyl phthalate was also reported to eliminate the severe drop in insulation resistivity characteristic of the parts in moist conditions when molded of other plastic materials.

New Radio Communication Method

A new method of radio communication between the northern and southern hemispheres — a method which could also be used to gain detailed information about outer space —is possible, according to a Cornell University scientist, Prof. Henry Booker, associate director of the Center for Radiophysics and Space Research at Cornell.

It is possible for magnetospheric waveguides to guide high frequency waves between the northern and southern hemispheres over paths that pass thousands of miles into outer space, declares Professor Booker.

According to Prof. Thomas Gold, chairman of the Astronomy Department and director of the Space Center at Cornell, the earth's magnetic field controls the motions of the extreme outer atmosphere so as to filament the plasma into millions of magneto-ionic ducts. These waveguides extend from the ionosphere in the northern hemisphere to the ionosphere of the southern hemisphere via the part of outer space known as the magnetosphere.

For the past year and a half Professor Booker has been investigating the possibility of using magnetospheric ducts as an agent in guiding high frequency radio waves between the two hemispheres. He studied the size and strength of the magnetospheric waveguides and their method of operation, and was able to establish that these magnetospheric waveguides are capable of guiding high frequency waves between the northern and southern hemispheres over channels that reach thousands of miles into space. Although such ducts may well be more than 10,000 miles in length, radio waves leave them with practically the same strength as they enter, declares the Cornell scientist.

New Insulating Varnishes—The Key to More Efficient Electrical Equipment

An Interview with Raymond H. Thielking, Technical Director, Schenectady Varnish Company, Inc., Schenectady, N. Y.

Increased production of molded or encapsulated motors and transformers has led to speculation about the future of insulating varnish systems. The following discussion defines the function of insulating varnishes and describes recent trends in equipment design which reaffirm the role of insulating varnishes as the key to improved electrical equipment.

Q. What are the main functions of insulating varnishes?

A. Varnishes are applied to supplement or improve other components of an insulating system. Depending on the requirements of the application, they can improve insulation life at higher temperatures, increase electric strength, extend the life of equipment exposed to humid, dusty or corrosive atmospheres or make possible the design of lighter equipment or components without reducing their efficiency. In many applications they also bond other components together and prevent movement of coils and subsequent failures due to abrasion and cut-through.

Q. What are the major types of varnishes and their applications?

A. The three major types of varnishes are: (1) air-drying, (2) solventless and (3) heat-reactive or polymerizing. The air-drying types are used primarily as protective coatings and for touch-up. The solventless types polymerize with heat into a void-free mass. They are used for intricate, small coils where freedom from voids and rigidity of the mass are required. The heat-reactive varnishes, which are used in the bulk of applications today, through-cure completely with heat. They contain solvents which are driven off during baking.

Q. What is the trend in electrical equipment design?

A. The steady progress of AIEE, ASTM and NEMA in setting temperature classifications above the old *105 C* (Class A) level, indicates the trend. Longer life at higher operating temperatures, smaller size without loss in efficiency — these are the main goals.

Q. What effect has this had on insulating varnish formulation?

A. The development of smaller, more intricate coils, rotating at higher speeds has in part been made possible by insulating varnishes with higher heat resistance and better bonding strength. The early oleoresinous varnishes gave way to the heat-setting phenolics and now the polyesters, epoxies and silicones are being used in increased volume.

Q. Which types of insulating varnishes now predominate?

A. Despite all the talk about Class B, F and H varnishes, the Class A thermosetting varnishes far surpass all others in total annual poundage produced. There is no question, however, that Class B and F varnishes are making significant inroads as more and more equipment is designed for operation at these higher temperatures.

For example, ISONEL* Polyester Varnish, which is priced slightly above Class A varnishes, withstands temperatures up to 175 C when used with ISONEL magnet wire.** By contrast, the epoxies, which are more costly, are limited to 130 C at most. For these reasons, the polyesters have gained greater acceptance to date.

Q. Do encapsulated motors have any real advantages over conventional varnished motors?

A. Yes. Encapsulated motors may have better moisture, chemical and weather resistance. However, because encapsulating materials are good thermal insulators, they also increase running temperatures. It is not unusual, therefore, for an encapsulated motor to show a 25-60% higher temperature rise than one of the same frame size insulated with a polyester varnish. The latter can be vented easier, hence made smaller, of simpler design and at lower cost. Heat-life is also significantly better. In our own company, we make a full line of varnishes and encapsulating compounds. So, "you pay your money and take your choice."

* Reg. T.M. Schenectady Varnish Company, Inc.

** Consult your wire supplier for data on ISONEL enameled wire.

Polyester varnish treated motors are easily ventilated and cooled. Result — lower temperature rise.

Encapsulating compounds hold heat. Result—higher temperature rise.

Inquiries should be directed to: Section E-13

In Canada: Schenectady Varnish Canada, Ltd.
309 Comstock Road, Scarborough, Toronto, Ont.

In Mexico: Schenectady Varnish de Mexico, S.A.
M. Antonio Casa No. 28 1er Piso B, Mexico 4, D.F.

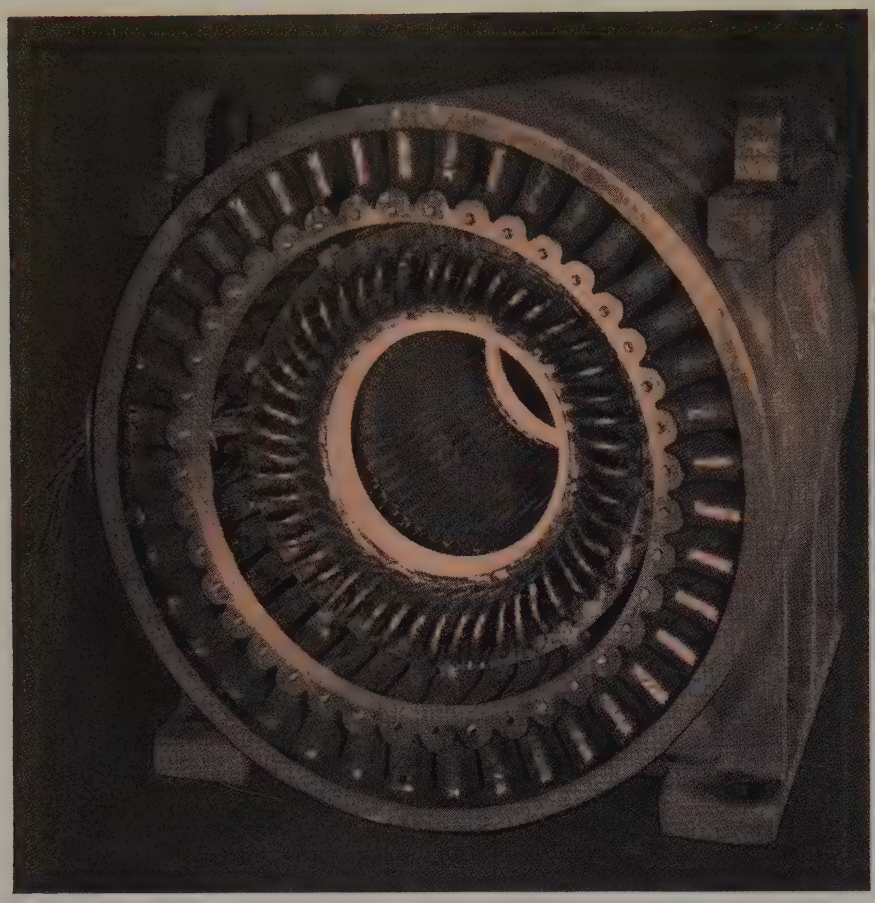
SCHENECTADY VARNISH COMPANY, INC.

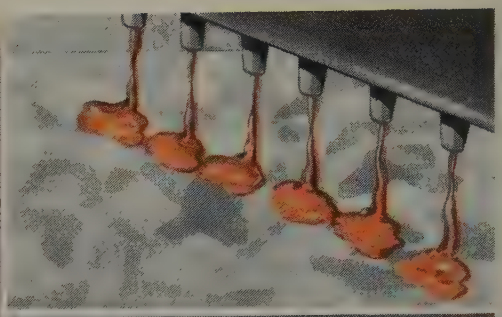
SCHENECTADY 1, N. Y.

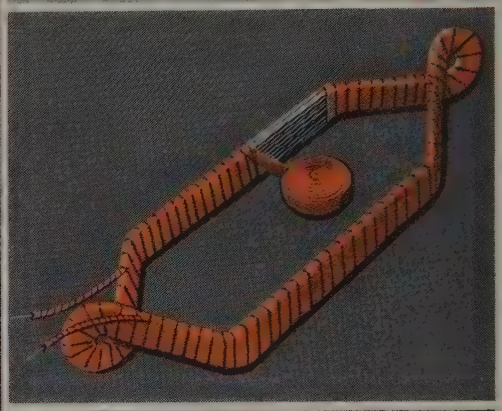
INSULATING VARNISHES AND WIRE ENAMELS FOR THE ELECTRICAL INDUSTRY

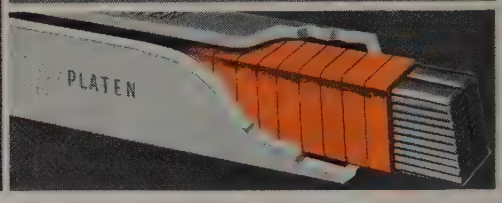
Print Ins. 18 on Reader Service Card

For Greater Power









Westinghouse Uses Dow Corning Silicones for Thermalastic "H"

Dow Corning solventless silicone resins are excellent dielectrics . . . have high bonding strength. When cured, they form tough, void-free, heat-stable insulating materials.

Westinghouse, for example, uses Dow Corning solventless silicone resin as a bonding agent and filling material between the overlapping mica splittings of their Thermalastic "H" insulation system. Thermalastic "H" is used by Westinghouse to extend the advantages of Class H insulation systems into large rotating equipment of all voltage ratings including 13.8, 16.5, and 18 KV.

Similar in basic construction to the Thermalastic insulation system introduced by Westinghouse in 1949, Thermalastic "H" utilizes the inherent thermal properties and intrinsic dielectric strength of mica and solventless silicone resin. The high degree of fill achieved by vacuum-pressure impregnating glass cloth and mica splittings with solventless silicone resin assures a void-free insulation unequaled in voltage endurance, low power factor, outstanding resistance to heat, moisture and other contaminants.

The top illustration shows large mica splittings on a fiber glass backing being coated and filled with solventless silicone resin. Next, another layer of glass fiber is added and the laminate is then cut into tape. The tape is used to lap wind the coils. A solventless silicone resin is then introduced by vacuum-pressure impregnation and the entire coil form is heat-cured. The resulting insulation system easily handles Class H temperatures.

Print Ins. 19A on Reader Service Card

Dow Corning is your best source for information and technical service on silicones.

first in silicones

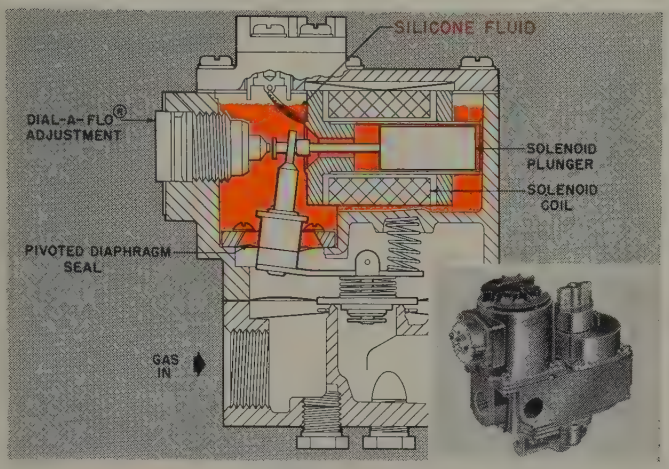
Dow Corning

...Specify Silicones

To Silence Solenoid Valve

General Controls Company of Glendale, Calif., immerses the operating mechanism of their Dial-A-Flow gas valve in Dow Corning 200 Fluid. Result: the viscous fluid cushions the snap action of the mechanism, and makes it silent. The undesirable "pop" of gas ignition and noise of plunger impact are eliminated. Silicone fluid is the ideal damping medium because it doesn't thicken or thin with temperature changes, has excellent dielectric properties, is resistant to oxidation and to breakdown under shear.

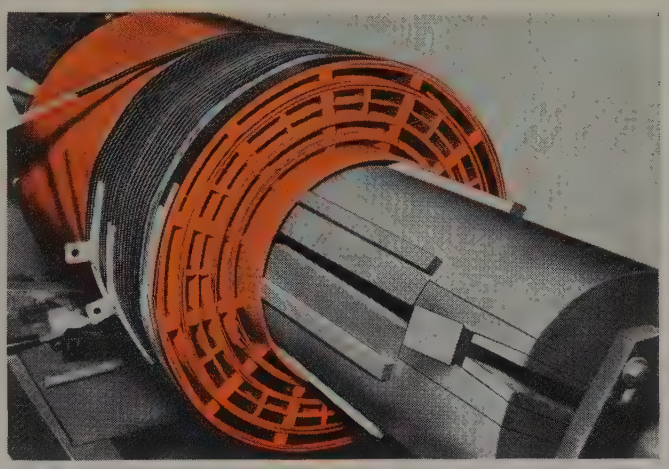
Print Ins. 19B on Reader Service Card



To Assure Reliability

Dependable performance of Class H unit-substation transformers is assured by I-T-E Circuit Breaker Company through specifying silicone-glass laminates for spacer strips, for support cylinders, for insulating diaphragms between secondary and primary windings, and for interphase barriers. Bonded with heat-stable Dow Corning silicone resins, glass laminates have high arc resistance, low loss factor, low moisture absorption . . . excellent mechanical and dielectric strength even after prolonged aging at 250 C. Used with other silicone insulating components, glass laminates permit smaller, lighter weight transformers that are easier to install and maintain.

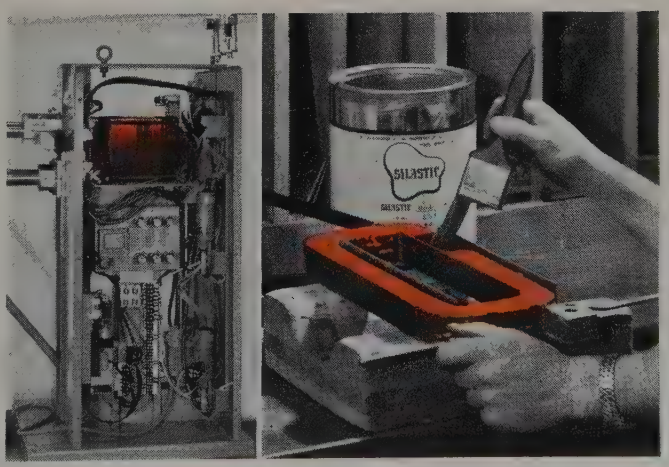
Print Ins. 19C on Reader Service Card



To Increase Welder Output

Peer Incorporated, Benton Harbor, Michigan, redesigned their welding equipment to take full advantage of the benefits offered by Dow Corning Silicones. Results: Power factor improved between 15 and 20% over conventional welders; transformer size reduced about 30%; interwinding breakdown raised to over 4000 volts; built-in protection against inadvertent abuse that would damage Class A and B insulation systems. More important, since redesigning with silicones, not a single Peer "300" Welder has failed for any reason. Basic to this remarkable insulation system is Silastic®, the Dow Corning silicone rubber, shown being applied to a transformer coil.

Print Ins. 19D on Reader Service Card



CORPORATION MIDLAND, MICHIGAN

branches: ATLANTA BOSTON CHICAGO CLEVELAND DALLAS LOS ANGELES NEW YORK WASHINGTON, D.C.

SPE Annual Technical Conference Highlights And Report on Insulation Papers

Six interesting papers on electrical insulation were presented at the 17th Annual Technical Conference of the Society of Plastics Engineers held January 24 to 27 in Washington, D.C. Four of the papers were presented at the Tuesday morning session on Electrical Insulation. One each was presented at the Reinforced Plastics and Thermoplastics sessions. Reports on these papers follow the news of society activities.

New society officers announced at the meeting are: President — Frank W. Reynolds, Plastics Laboratory, IBM; Vice President, Engineering—James R. Lampman, General Electric Co.; Vice President, Administration—John Delmonte, Furane Plastics Company; Secretary—Maurice F. Malone, Canadian Resins & Chemicals Co.; Treasurer—John Berutich, Haveg Industries.

The 18th Annual Technical Conference will be held at the Penn-Sheraton Hotel, Pittsburgh, Pa., January 30 through February 2, 1962. General Chairman will be John E. Parks, Koehring Co.

PAG on Electrical Insulation

Three new officers were elected at the meeting of the Professional Activities Group on Plastics in Electrical Insulation. They are: Chairman—A. Zavist, General Electric Co.; Vice Chairman—Len Buchoff, Electro Tec Corp.; and Secretary—George Chadwick, Speer Carbon Co.

Reports on papers of interest to *Insulation* readers follow:

A Study of Polymers Applicable to Insulation Systems

By K. A. Torossian and S. L. Jones, General Electric Co.

During the past decade many new dielectric materials have been introduced in the electrical industry. Of particular importance in the insulation of electrical machinery has been the development of systems using thermosetting polymers such as epoxy, polyester, phenolic, and silicone resins.

However, such properties as postcure gassing, thermal stability, and high-temperature bond strength have been stumbling blocks for the insulation engineer. Experience has shown that these properties can ultimately affect the dielectric endurance of an insulation when subjected to high voltage stresses. Test methods for the direct and accurate determination of the thermal stability and gas evolution characteristics at elevated temperatures of fully cured polymeric systems were developed whereby the behavior of the polymers under certain conditions can be predicted.

The thermal stability tests were carried out on the "Chevenard Thermobalance." The heart of this instrument is a sensitive balance arm, one end of which supports the sample to be tested inside a temperature controlled furnace. The other end of the balance arm activates the pen of a continuous recorder. As the sample is slowly heated, its weight is recorded against time on the recorder chart. By determining the temperature in the furnace, a recording of the sample's weight versus temperature is obtained, from which the weight loss of the insulation sample at any desired temperature may be determined.

Two test series were conducted. In the short-time tests, the temperature of the oven is raised at a constant rate of temperature rise (2½°C per minute over a range of 25° to 300°C). It was found that up to 100°C, most of the examined polymers were of the same order of stability, but above that temperature level those with poor thermal stability exhibited appreciably greater weight loss. By determining the critical temperature at which 0.1% weight loss is detected, it was found that for the phenolics, vinyl ethyl ether and asphaltic systems the critical temperature was in the range of 100°C. For the epoxies it was 250°C, while in between are found silicones, general-purpose unsaturated polyesters, and alkyds.

In the constant temperature test, the oven temperature was brought up to a certain level (175°C) and held for a given time (16 hours). In this particular test, the epoxies exhibited greatest stability—hardly any weight loss was noticed. "Butvar" phenolic lost up to four percent, while the silicones, polyesters and modified asphalt systems exhibited close to two percent weight loss.

It was found necessary to supplement the thermal behavior of polymers with their postcure gassing properties. Investigations were carried out to determine the amount of gassing when a sample was held at a certain temperature under vacuum over a given length of time. Pressure increase in the apparatus indicated the amount of gassing. Not all polymers exhibit the same gassing characteristics under similar conditions, and it was necessary to study some for very long periods of time. The authors bring out one interesting point as the result of this work: For the systems investigated, the anhydride-cured epoxy gave off seven times as much volatiles as the amine-cured epoxy.

Moisture Resistant Coatings For Class B Printed Circuitry

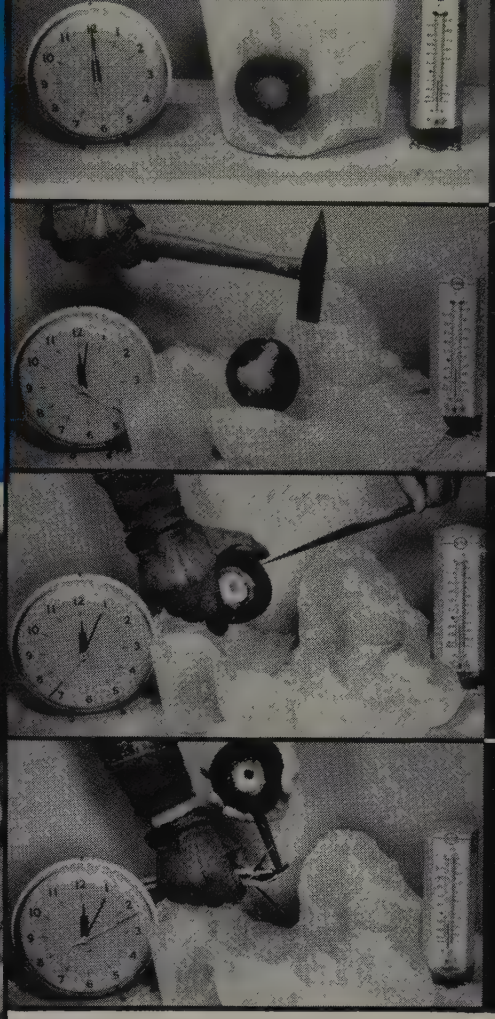
By A. F. Ringwood, General Electric Co.

This very extensive paper described a program whose prime objective was to recommend—with standing instructions for its use—a coating material which, when applied to assembled printed circuit boards, would meet the requirements of MIL-E-5272B Moisture Cycling. Since the coatings were to be used on the production line, processability, preferably by a dip method, was of a prime importance. *continued on page 29*

LIPKNOT CW TAPE

TRIPS AND STICKS

T 20° BELOW



THIS IS THE COLD-WEATHE VINYL TAPE YOU'VE BEEN WAITING FOR . . .

At 20°F below zero, this remarkable vinyl tape

- **Strips easily from the roll . . .**
- **Remains completely flexible . . .**
- **Sticks down instantly — molds perfectly — holds permanently!**

Try it in your home freezer – write for a sam roll on your letterhead today!

ONLY
RU
NIZED
UTORS
COMPANY, INC.

YMOUTH RUBBER COMPANY, INC.

ALITY SINCE 1896 CANTON, MASSACHUSETTS

FORMVAR . . .

better than ever for broad range hermetic use

Now, a new magnet wire enamel formulation based on FORMVAR resins sets a new standard of performance in hermetic units. Proved in the field as well as the laboratory, the new formulation maintains the unequalled physical and chemical properties of a standard FORMVAR-with-phenolic enamel and also offers these important features:

1. Excellent resistance to attack by liquid or gaseous R-22 refrigerant.
2. Shows no physical softening with heat and pressure indicating best protection against short time, high overload stress on motor windings.
3. Maximum insolubility in almost all conventional solvents.
4. Outstanding resistance to hydrolysis.

The development of this new enamel represents a major step forward in the technology of insulating enamels based on FORMVAR resins. The enamel or coated wire is now commercially available from your regular supplier under the FORMETIC or other trademark.

Why not consult your supplier for more details. It will pay you real dividends in trouble-free performance.

For complete literature write Shawinigan Resins Corporation, Springfield 1, Mass.

SALES OFFICES: ATLANTA CHICAGO LOS ANGELES
NEW YORK SAN FRANCISCO SPRINGFIELD

FORMVAR®

polyvinyl formal by SHAWINIGAN RESINS

Print Ins. 21 on Reader Service Card

Three resin systems were considered as bases for an effective coating —the epoxies, polyurethanes, and a combination of the two. In order to determine their effectiveness as moisture barriers on printed circuits, it was first necessary to know the effect of moisture on the uncoated circuit. This information would give the minimum results expected with a coating after long exposure to moisture and would also give the rate at which the moisture penetrates the barrier.

Test boards used in the investigations were: paper-phenolic, epoxy-glass, and epoxy-paper. Two types of patterns were obtained for testing: target and comb.

Four types of cleaning procedures for printed circuits were evaluated. The ASTM cleaning procedure proved to be the most effective for cleaning prior to coating with protective materials. Production type cleaning (brushing with trichlorethylene and drying with air) appeared to be slightly better than ultrasonic cleaning, but the difference was very small. The ASTM procedure is the longest to perform with ultrasonic cleaning being done in about 15 seconds. A new procedure using "Freon" offers possibilities of being used in production type set-ups. Although it does not give results as high as some of the other methods, it could possibly be improved.

All the commercially available materials were unsatisfactory either for processability reasons or for nonconformability to the requirements of the specifications. None could be degassed without the addition of solvents or thinners to cut the viscosity. Few coated uniformly or without excessive run-off in the curing oven. The most promising was a proprietary epoxy-anhydride formulation because one of two boards satisfactorily passed the moisture cycling test. The author recommends further testing and continued work on modification of the basic formulation to evolve a final coating compound which meets all requirements of the specification.

Improved Reliability for Printed Circuits With Protective Coatings

By Edward W. McGuiness, Laboratory for Electronics, Inc.

This paper is concerned with improving reliability of printed circuits by coating the finished circuit with a protective, water-resistant and chemical-resistant insulating coating. In the tests an epoxy-glass laminate 1/32" thick with both sides covered with 2-ounce copper was used.

Three different coating materials were investigated—an air-drying varnish, a modified phenolic-silicone, and a polyamide-modified epoxy. The air-drying varnish would be most desirable from the processing viewpoint, since no oven facilities would be needed and pot life was indefinite. However, since both sides of the board contained many components and modules crowded close together, it was difficult to coat satisfactorily with one application of this material. Even by using higher boiling solvents as the thinner, it was difficult not to get some excessive buildup in areas where the drain might be impeded by components.

The silicone-phenolic varnish gave desired coating thickness with one dipping. However, it was quite expensive and needed a long cure time. Another drawback was the basic lack of adhesion to the base laminate.

A two-component polyamide-modified epoxy system could be cured at room temperature or for two hours at 150°F. The material is solvent thinned which extends the pot life of the mixed blend to over eight hours. The coating had excellent wetting for both the base laminate and the various components. Care had to be exercised to keep bubbles out of the coating since they did not break easily. However, because of the excellent adhesion, any single bubble, imperfection, or void would be a single area and would not serve as an opening for moisture to get under the coating. It was felt that this material was superior for the specific application and requirements.

Use of the protective coating allows the conductor lines to have the very minimum spacing with the assurance that there is adequate flashover protection. The effects of moisture, altitude, and dirt are eliminated, and greatly improved flashover voltages are possible. Components mounted on the boards are held more securely with less strain on the component leads. Water penetration by wicking along an exposed glass fiber has been eliminated. The coating also tends to reinforce and strengthen the entire assembly. The properties of the coating are such that they will make possible more compact designs with good reliability.

Mica as a Reinforcing Material For Printed Circuit and Terminal Board

By E. G. Dingman, The Macallen Co., Inc.

Within the last five to ten years, mica papers have become available. They are of two principal types—reconstituted mica and integrated mica. Reconstituted mica papers when laminated using synthetic resins produce laminates of outstanding electrical properties. Properties are comparable in most respects with those of epoxy-glass laminates and are superior in several important aspects. The integrated materials cannot be ignored, however, since they possess a few properties which may make them useful in a particular application.

Epoxies were used because of their superior moisture resistance and ease of fabrication. (Recent work indicates that several other resins may be of value.) Conventional impregnating and laminating techniques were used.

These laminates were found to have moduli of elasticity in the range of 10 to 15 million psi. All laminates were found to be self-extinguishing. The coefficient of expansion is near that of copper. Electrical properties are excellent, and in the case of the reconstituted muscovite paper they are almost unchanged after exposure to high humidity.

The material appears to be highly satisfactory for electrical uses and is competitive in price with other types of laminates.

The Effect of Finishes on Heat Resistant Phenolic and Modified Epoxy Laminate Systems

By John Miglarese, Micarta Div., Westinghouse Electric Corp.

This paper gives the results of an investigation of finishes on glass

fabric reinforcement and their effect on the properties of heat-resistant phenolic and epoxy systems, particularly on laminates that have been postcured at high temperature.

The fabric chosen for this investigation was 181-112 heat-cleaned glass cloth which was finished with various heat-resistant treatments. One percent solutions of commercially available finishing agents (A1100 and Z6020), as well as a silicone resin, were applied to the heat-cleaned fabric in a conventional horizontal impregnating machine. The fabrics with the various finishes were then treated with liquid resin solutions to make prepregs.

Both were postcured to 400°F on a programmed cycle lasting 20 hours. The results of the physical and electrical properties were tabulated and the most important features pointed out in form of bar graphs.

The properties of postcured phenolic laminate systems depending directly on the resin-glass bond were substantially improved by the use of A1100 and Z6020 finishes—particularly water absorption, dielectric breakdown parallel to lamination, dielectric constant, and flexural and bond strengths.

The epoxy system showed good electrical properties on all of the finishes including the heat-cleaned fabric (without finish), but the physical properties showed up better with the use of chemical finishes with not so pronounced a change from the heat-cleaned control samples. The flexural strength measured at 150°C resulted in greater than 50 percent retention of initial flexural strength for all epoxy laminates as required in NEMA Grade G-11.

Paste Extrusion of Filled Compositions Of "Teflon" 6 TFE-Fluorocarbon Resin For Wire Insulations

By R. W. Johnson, E. I. du Pont de Nemours & Co., Inc.

Certain applications for insulated wire require greater resistance to abrasion and cut-through than is offered by conductors insulated with unmodified fluorocarbon resins. Investigations were made to determine the processability of "Teflon" 6 resin blended with various fillers and paste-extruded as wire insulation. At the same time, measurements of the effect of the fillers on abrasion resistance, cut-through resistance, and electrical properties were made.

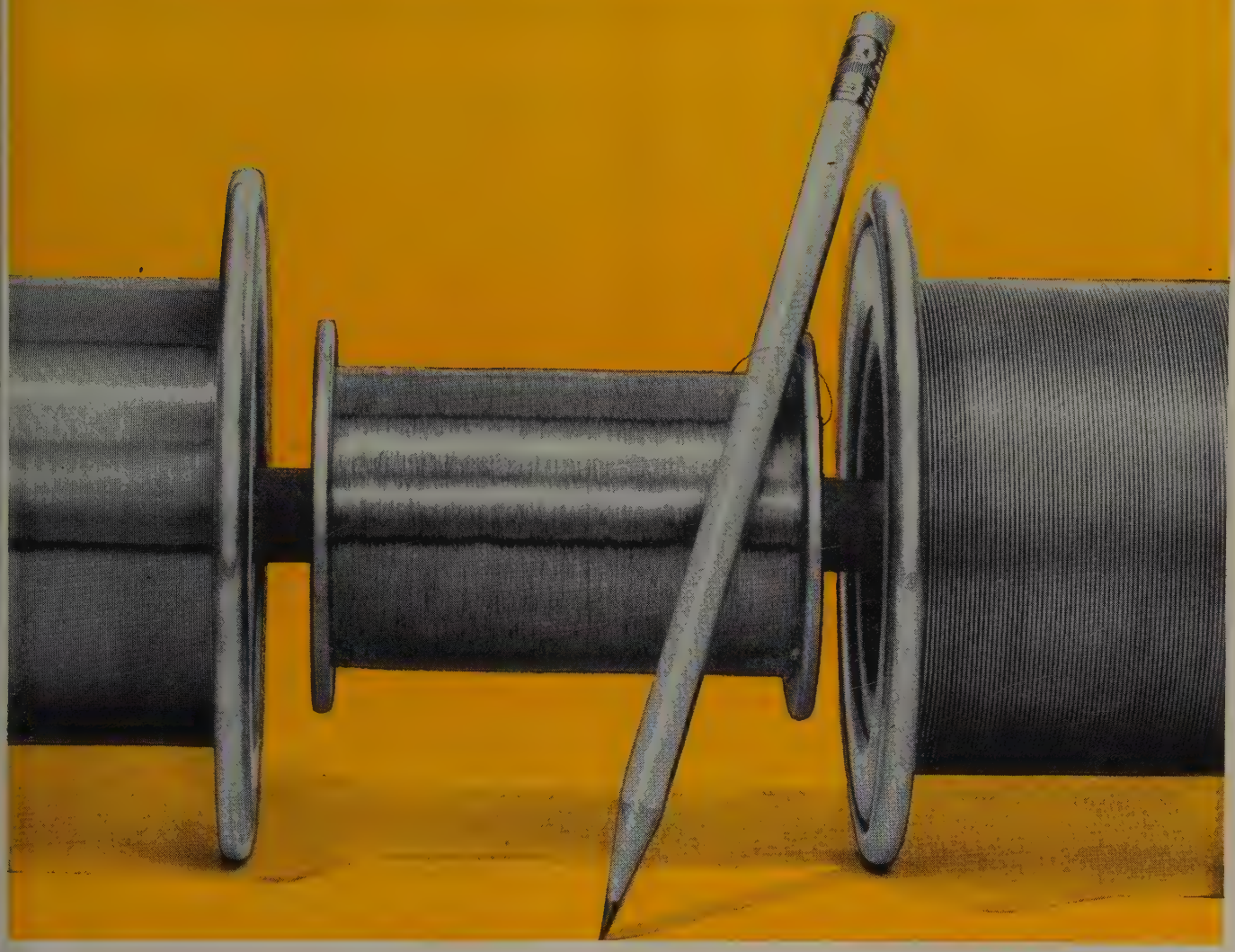
Various fillers were evaluated, including asbestos, glass fiber, fibrous magnesium silicate talc, calcium silicate, finely divided silica, graphite, talc, and quartz. Dry blending worked well with all except asbestos, glass fiber, and silica. Asbestos and glass fiber had to be dry blended at —40°F to avoid agglomeration. The silica was difficult to blend. However, coagulation of the filler with a Teflon aqueous dispersion did not cause agglomeration during blending.

Magnesium silicate, talc and graphite fillers had the least effect on processing. None of the fillers could be processed as E-28 constructions. The magnesium silicate, calcium silicate, and talc all processed well as EE-28 constructions when blended to a concentration of 2.5% filler. Asbestos and glass fiber caused the Teflon to be oversheared as it was forced through the die. The silica absorbed too much of the lubricant, and the mixture was too dry for extrusion at practical pressures. The quartz-filled resin extruded satisfactorily, but the quartz particles were so large they protruded through the insulation.

The abrasion resistance of insulations of paste-extruded Teflon 6 resin is improved 10 to 150 percent by blending fillers with the resin prior to lubrication and extrusion. By using special constructions, the addition of filler has little or no effect on the electrical properties. In EE-type constructions, the room temperature cut-through resistance of some insulations was improved 30 to 50 percent. The high temperature cut-through resistance was much better with filled insulations than with insulations of pure resin.

The magnesium silicate-filled material offers the easiest extrusion, the most improvement in abrasion resistance, and the least effect on electrical properties. The process of simultaneously extruding a primary and a filled jacket affords a means of improving physical properties without affecting electrical properties.

SYLVANIA MAKES ALL THREE—ALLOY, CLAD AND PLATED WIRE



Where to start when you're writing specs

—Let Sylvania give you an unbiased recommendation on wire

When you're designing and specifying materials for special purpose applications, selection of the proper wire can be all-important. Clearly, there are wide variations in corrosion resistance, oxidation resistance, strength and conductivity.

That's why more and more engineers *start* with Sylvania when they specify wire. Of all major manufacturers, only Sylvania makes all three types of bare wire – alloy, clad and plated. Sylvania makes them in a full range of sizes, too—.002″ to .250″. Each and every one retains optimum characteristics up to recommended operating temperatures.

With such a complete line, you can be sure that a Sylvania recommendation is unbiased. It's based on *your* needs—*not* restricted by a limited line. Full details—for future use or help on a present project—are yours at Sylvania Electric Products Inc., Parts Division, Warren, Pennsylvania. Call or write.

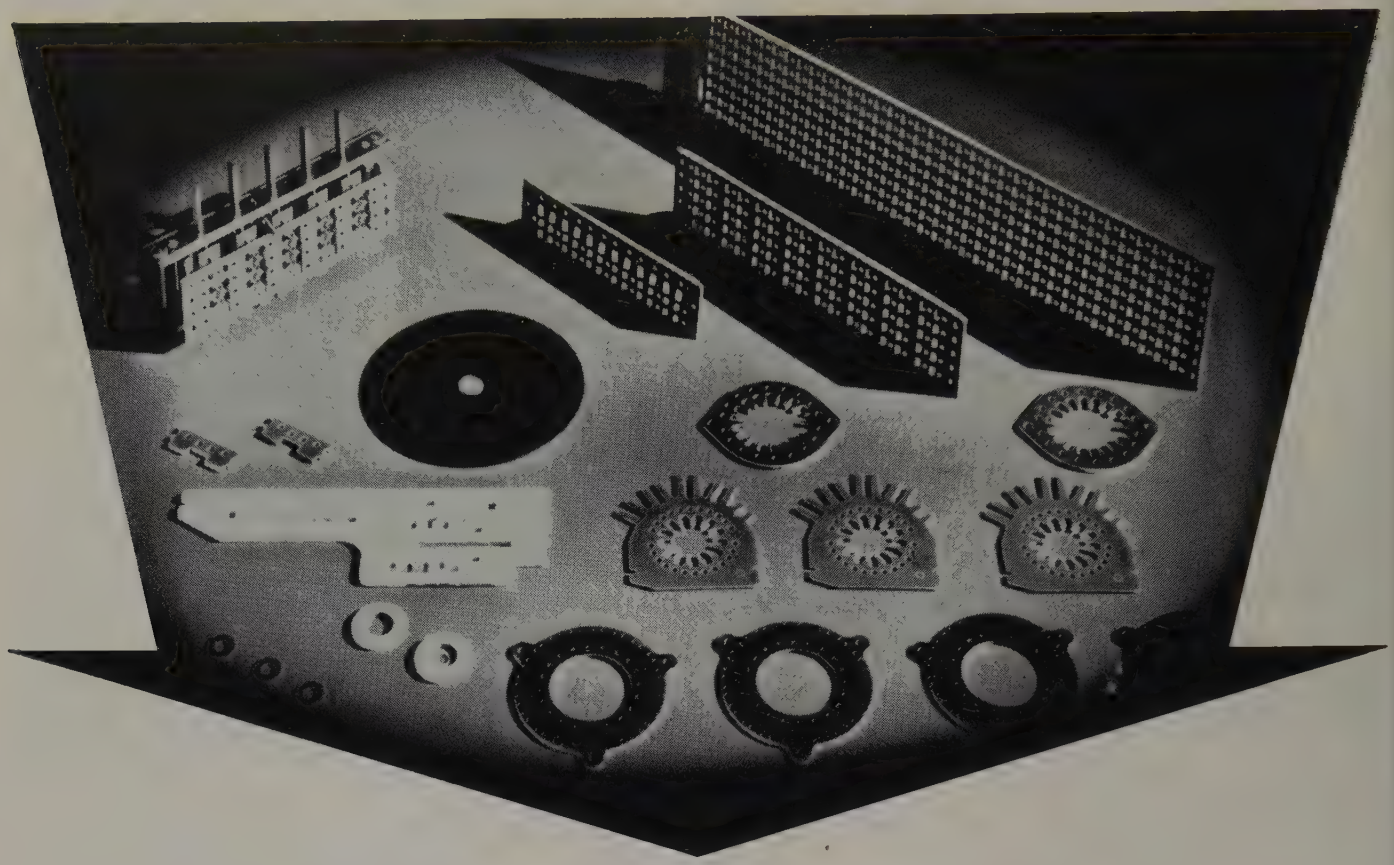
SYLVANIA

Subsidiary of **GENERAL TELEPHONE & ELECTRONICS**

GENERAL SYSTEM

Print Ins. 23 on Reader Service Card

What's different about specifying and buying fabricated parts like these from Richardson



A "GUNG HO"* ATTITUDE

There *are* beneficial differences when you buy from the Richardson salesman. He represents a company geared and manned by experienced personnel *"working harmoniously" to provide job shop attention and service to your specific electrical or electronic needs. The differences continue with emphasis on clear customer communications. He is trained to tell you effectively about Richardson's two fabricating plants, and discuss intelligently the many different manufactured grades of laminated Insurok® rods, tubes, sheets, and fabricated parts. He has case history samples to share with you in discussing electrical insulation that can cut your cost and improve equipment performance.

In turn, the Richardson man clearly presents your electrical needs immediately to our plants, assuring accurate information as to what you want in fabricated part performance, delivery and competitive prices.

In addition, you get better fabricated electrical parts from Richardson because of our undivided responsibility from the original manufactured material through the finished piece. The job-shop-service policy is backed up with substantial production facilities and a careful quality control system.

Your order will be produced by skilled men working together in harmony and getting your job done just right with a minimum of cost. The Marines call it *Gung Ho*. It comes when a company is specialized, experienced and versatile. Call the Richardson salesman today and put this attitude to work for you.

Write Dept. 13 for free technical data

THE RICHARDSON COMPANY

Sales Offices In Principal Cities

2693 LAKE STREET, MELROSE PARK, ILLINOIS

Laminated Fabricated and Molded Plastics

Print Ins. 24 on Reader Service Card

New Developments in Epoxy Resins

New Low-Cost Method for Encapsulating Motors -Part 4

By Stan Rejda, President, and Dr. Henry Lee, Technical Director, The Epoxylite Corporation, So. El Monte, Cal.

The rapid acceptance of the epoxy encapsulated motor by industry for use in severe environments has resulted in considerable pressure being brought to bear on the techniques of applying epoxy resins so as to reduce production labor and mold costs.

Manufacturers of encapsulated motors, for example, have claimed that the introduction of flexible, crack-resistant, low-cost epoxy resins has made the encapsulated motor not only a major competitor to totally enclosed, fan cooled designs, but potentially a direct competitor of the varnish impregnated motor in the integral horsepower range.

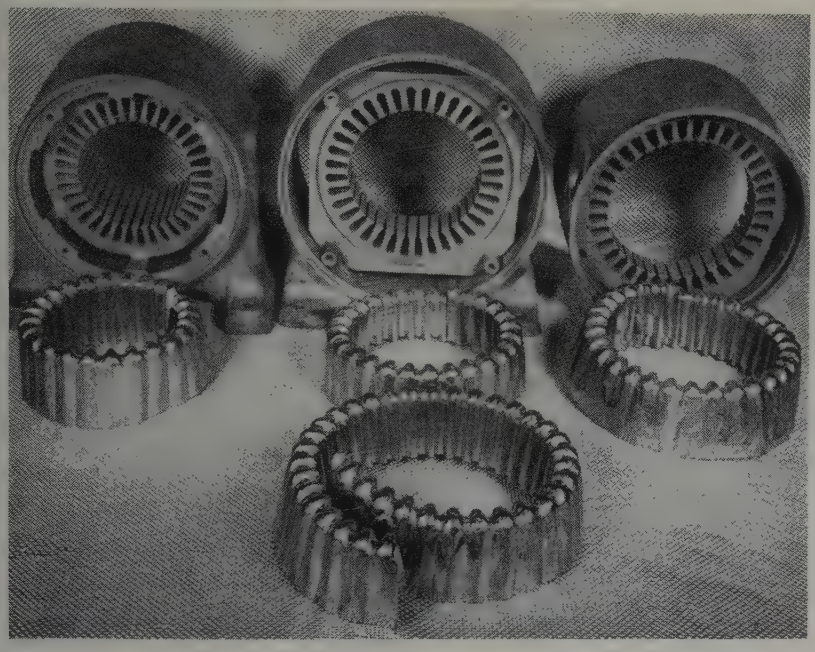


Figure 1, encapsulation molds made of non-magnetic foil can be adjusted over a range of stator diameters.

Figure 2, scissors serve to trim stator end mold to correct length. The mold may be similarly trimmed to match the height of the windings.

The major economic hurdle remaining to such widespread production of encapsulated motors has been the high tooling costs of permanent metal molds, and the labor costs associated with their clean-up.

However, several new plastic molds —made from vacuum formed polypropylene sheeting or epoxy-glass layups—have already cut mold costs from a typical value of $250 to $25.

Now, a still newer mold design offers even lower initial costs, as well as technical advantages. The new mold design is particularly adapted to production of a wide range of sizes of encapsulated motors—whether it be on a motor manufacturing production line—or in a motor rewind shop where burned-out, varnish-insulated motors of all sizes must be rewound and encapsulated.

The new mold design, invented and developed in the laboratories of The Epoxylite Corp., and being introduced commercially at this time, features adjustability, low cost, ease of application, and enhanced merits in the final encapsulated motor.* Its essential features involve a corrugated channel of non-magnetic metal foil, as shown in the accompanying photographs.

These channels, which serve as end caps or molds over the ends of the windings, may be adjusted to give a range of diameters. They may also be trimmed with common scissors to accommodate any length winding extension. Because of the corrugations, the molds may also be pulled in on the outer circumference so as to provide close fits to even 2-pole windings, which have high flair to their shape and which require more expensive split molds in other mold designs.

Because the molds are adjustable and give a close fit to virtually any size and shape of winding, less epoxy

**Patent applied for.*

Figure 3, the trimmed mold is snapped together for insertion of the windings.

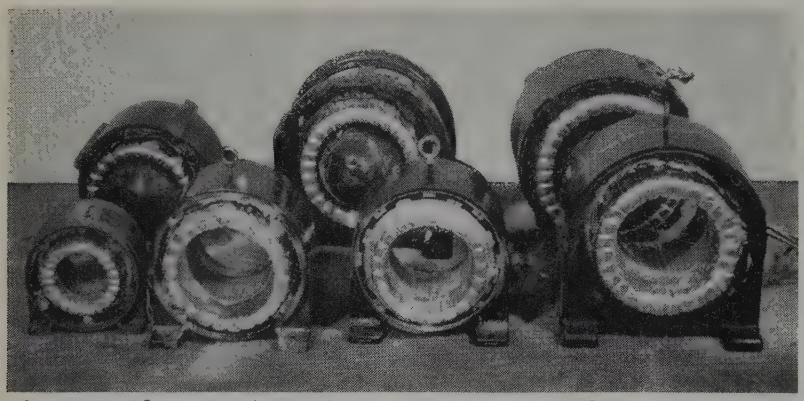


Figure 4, wide range of size of motors may be encapsulated with but three basic size adjustable end molds.

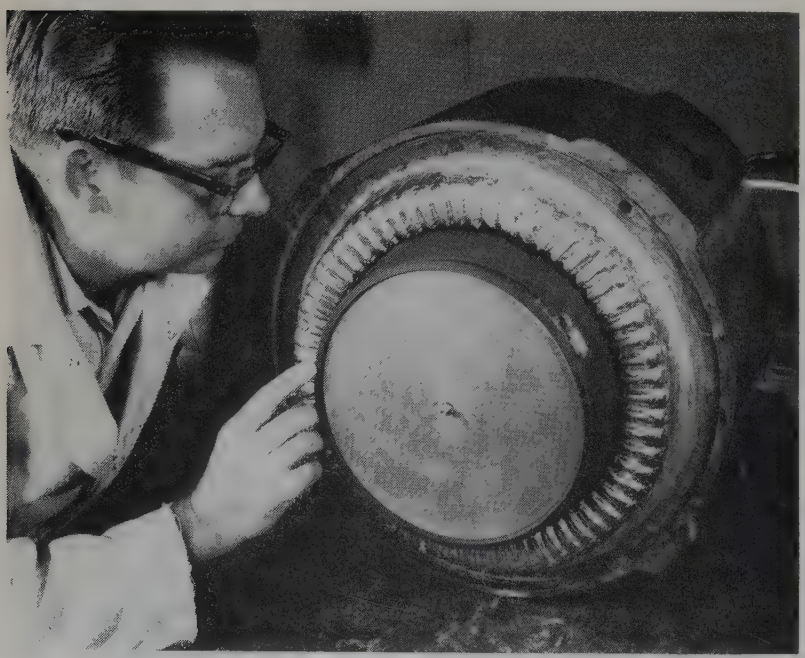


Figure 5, 40 hp stator with adjustable metal mold and large experimental bore expander.

compound is required to completely fill and seal the windings. Savings in material of as high as 27% have been realized on some motors in comparison with older mold designs.

Channels of three widths have been put into production to date. These widths have been selected to handle the windings normally encountered in motors of 1 to 100 hp.

These channels need only be adjusted or trimmed to size, inserted over the windings, and bonded to the stator iron with a high chemical resistant epoxy adhesive.

An adjunct to these metal end caps or molds are inflatable rubber bore molds. These are heavy-walled cylinders of high temperature resistant rubber, which are inserted in the bore of the motor and inflated. The inflated bore mold seals the slots of the stator core, and seals the parting line between the laminations and the end caps. (A special plastic film wrapped around the rubber bore mold serves as a release agent for the rubber bore mold by preventing the epoxy resin from adhering to the rubber during cure.)

A small hole, cut in the side of the end cap, serves as an exit for the leads and for air exhaust. A similar hole in the end cap on the other end of the windings serves as a pouring hole for the epoxy resin.

Because the molds fully contain the epoxy resin during cure, ultra low viscosity resins may be employed. By proper adjustment of pot-life, these low viscosity resins are allowed to soak throughout the windings, thoroughly filling the windings and saturating all the insulating materials. All of the air and moisture is removed from the windings and the magnet wire is thoroughly wet and impregnated. The low shrinkage inherent in most epoxy resins then allows the resin systems to gel and cure "in situ" with complete, void-free fill assured. Heat runs between vacuumed and non-vacuumed encapsulated motors show that the fill achieved with the non-vacuumed unit is equivalent to that of the vacuumed unit when using the proper epoxy compound. Hence, expensive vacuum and pressure equipment is not required, and the high labor costs,

inherent in loading, cycling, and unloading vacuum chambers, are avoided.

Thus, these new molds literally permit encapsulation of motors with high quality epoxy resins with absolutely no capital investment. For example: (1) The epoxy compound is supplied in preweighed units, so no scales are required. (2) The compound and curing agent may be mixed by a wooden stirrer if done conscientiously, so no mixer is required. (3) The adjustable metal molds are low cost and only as many molds as are required for existing jobs need be ordered. Hence, there is no expensive mold tooling-up costs as there was previously. (4) The bore expanders are also low cost and may be directly expensed to the job, with no capital investment. (5) Room temperature curing compounds may be employed in many instances so not even ovens are needed.

Of course, the above represents an extreme case, as only a modest investment can increase production markedly. For example, simple platform scales costing $50-70 permit mixing resin in bulk with considerable thoroughness and a savings in bulk prices; simple 5-gal mixers costing but $65 permit thorough mixing of as much as 200 lbs of compound per hour—equivalent to about 500 hp of encapsulated motors per hour—with savings in manpower. Similarly, ovens, if available, permit use of lower cost heat curing epoxy resin systems.

Thus, there is no need for $20,000 vacuum pressure installations, for $10,000 automatic blenders, or for $100,000 investments in molds.

Of course, for very high production rates, a motor manufacturer using these molds could justify automatic mixing machinery and make further labor savings. But essentially, this new mold system permits any independent rewind shop, any steel mill repair shop, or any motor manufacturer, to produce high quality encapsulated motors right in the shop.

Another feature of these new molds is that they may be removed, if release agent is used on them, or more preferably, the molds may be left in place on the windings. The chemical

Figure 6, four 20 hp motors in different stages of encapsulation. From right to left: (a) unit has end caps installed, (b) unit has bore mold installed, (c) unit has been encapsulated and the mold removed, showing excellent encapsulation, and (d) unit has metal end mold still in place, and stainless steel bore-liner has been added to provide a low cost "canned" encapsulated motor.

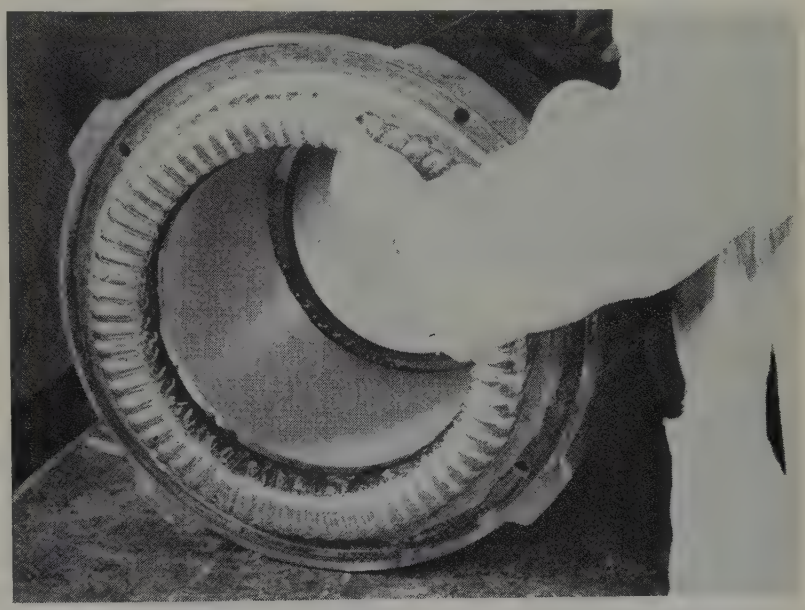


Figure 7, installing stainless steel bore line into 40 hp pump motor.

Figure 8, sealing bore liner to end mold with high chemical resistant epoxy adhesive.

Figure 9, mockup of manufacturer's production line set-up for handling cores only with metal end caps.

resistance of stainless steel or aluminum, supported mechanically by cured epoxy resin, is thus provided to the windings. Because there is no labor cost involved in removing and cleaning up molds, or in touching up "beauty marks" in the casting, the low cost of the molds is more than offset so that it is cheaper to leave the molds on and to provide the user with a better motor.

Going a step farther, it is possible to use metallic foils elsewhere in the unit to further produce essentially a "canned" motor. Photographs accompanying this article show installation of 0.002 inch stainless steel foil in the bore of various motors, for example. However, because low cost, low thickness metal foil does not use up any appreciable percentage of the air gap, the air gap need not be increased, so that no decrease in motor efficiency is necessary, contrary to standard canned motor designs in which the thick, welded, unsupported metal sheeting requires large air gaps and lowered motor efficiency.

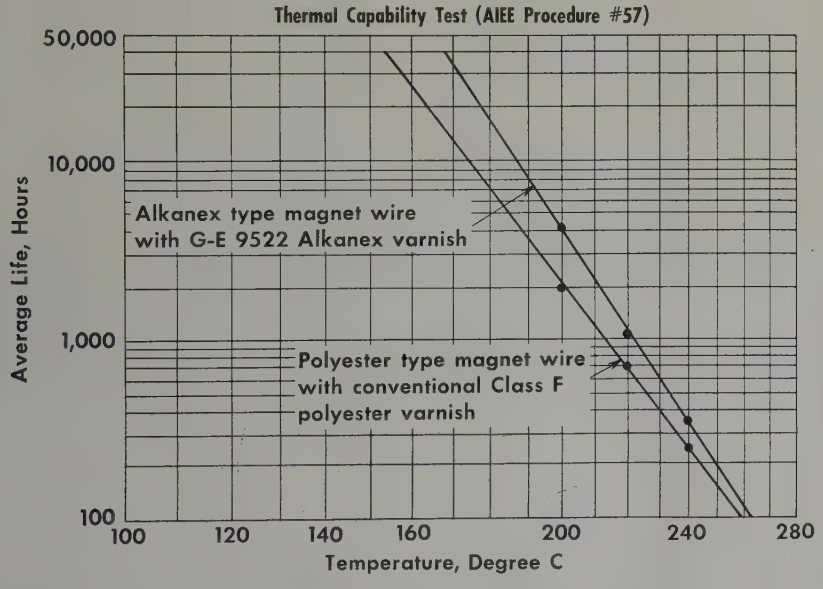
New General Electric

CLASS F ALKANEX INSULATING VARNISH

Alkanex® 9522—General Electric's new all-purpose insulating varnish—represents an important insulation breakthrough in Class F materials.

Performance-proved by laboratory tests at G-E's Insulation Application Center, Alkanex 9522 far exceeds Class F requirements—operates near Class H temperatures, but at less cost. OUTSTANDING HEAT LIFE of this new G-E varnish is demonstrated by tests showing satisfactory operation after 40,000 hours at 168 C! At the same temperature, conventional Class F polyester varnish fails after only 15,000 hours.

FOR ADDITIONAL INFORMATION ON ALKANEX 9522—or any of the quality G-E Class F materials—contact your Authorized G-E Insulating Materials Distributor, or write Section 108, Insulating Materials Dept., Schenectady 6, N. Y. 845-11

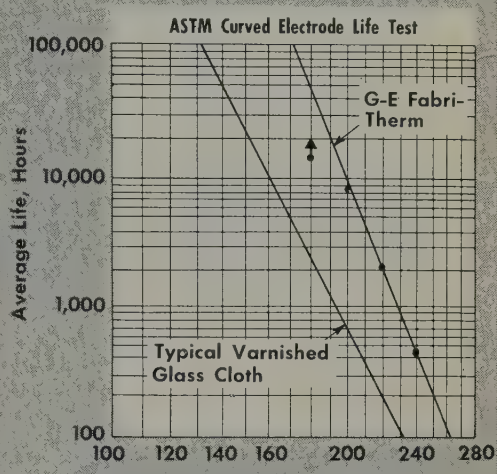


ALKANEX TYPE MAGNET WIRE treated with G-E 9522 Alkanex varnish outperforms other polyester wire with polyester varnish at Class F temperatures, as proved by results of this thermal capability test conducted according to AIEE #57 Test Procedure.

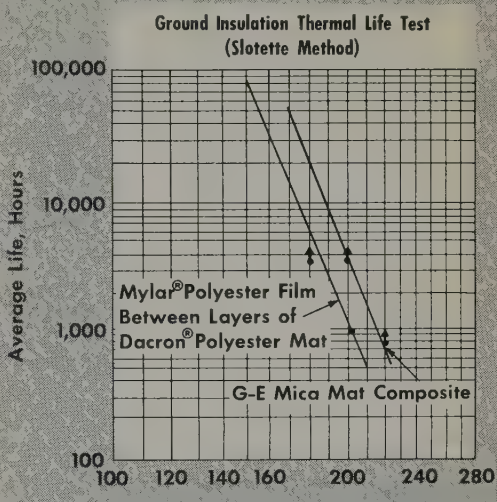
GENERAL ELECTRIC

Print Ins. 27 on Reader Service Card

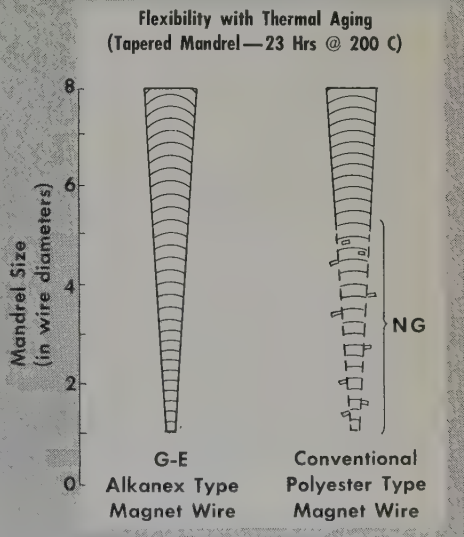
TESTS PROVE RELIABILITY OF THESE OTHER G-E CLASS F MATERIALS



G-E FABRI-THERM for phase and layer insulation extrapolates at 180 C for 40,000 hours, has logged 15,000 actual hours to date at 180 C with excellent results.



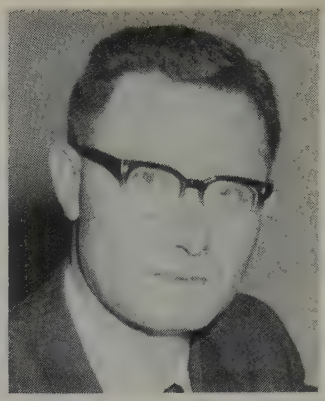
G-E MICA MAT COMPOSITE—for ground insulation—has a thermal life in excess of 40,000 hours at 172 C as shown by the slotette test method.



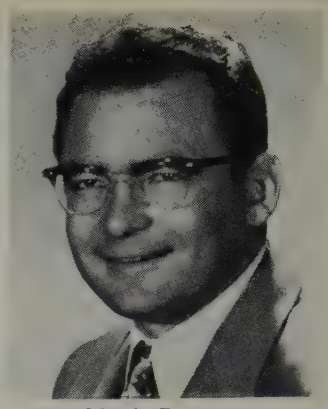
MAGNET WIRE ENAMELED WITH G-E ALKANEX, available from leading magnet wire manufacturers, gives excellent flexibility after 23 hours at 200 C . . . no cracking or peeling at 1X; other polyester magnet wire tested shows significant cracking at 5X.

J. P. Dallas

C. L. Sidway



H. N. Miller



M. A. Brenner

High Potential Dielectric Testing

Editor's Note: *The following are excerpts from the transcript of a technical seminar held on the West Coast to clarify some of the confusion and disagreement regarding dielectric strength testing. Members of the panel were: J. P. Dallas of Hughes Tool Co., Fellow of AIEE, and chairman of the Subcommittee on Dielectric Testing of Aircraft Equipment; H. N. Miller, vice president, engineering, of Associated Research, Inc., one of the largest manufacturers of high potential dielectric strength testing equipment, member of AIEE, IRE, and ASTM; and C. L. Sidway of the Southern California Edison Co, member of AIEE and expert on the dielectric testing of large rotating machinery. The moderator was M. A. Brenner of Brenner-Fiedler and Associates, Inc.*

Brenner: What do we mean by dielectric strength?

Miller: Dielectric strength is defined as the voltage rating at which electrical failure or breakdown occurs. It is commonly expressed in volts per mil, obtained by dividing the breakdown voltage by the thickness of insulation. The value is influenced by the method of application of voltage, frequency, wave shape, temperature, and surrounding medium.

Brenner: What about leakage current, test current, circuit current, and so forth?

Sidway: When you apply a direct potential to an insulated structure, the initial surge of current is known as the charging current. As time goes on the current drops exponentially, and another effect known as absorption current becomes predominant. If the potential is left on long enough the current eventually reduces to a steady value, known as the conduction current. In insulation testing, it is the conduction current in which we are primarily interested. When testing with alternating potential the charging component is extremely large compared to all the other components, so leakage current is relatively minor.

Brenner: Is breakdown an excessive steady current, arcing, or short circuit?

Sidway: Breakdown is usually described as a destructive discharge through the insulation. It is characterized by a disproportionately large change in the testing current; in other words, an avalanche. After breakdown failure occurs you usually cannot restore the voltage. For example, while slowly increasing the voltage you may find current increasing quite rapidly at a certain point, but you may have only reached the point where some of the voids in the insulation material have become ionized. If that is the case you can back down on the voltage and return to the same place as often as you wish. In a true breakdown you will not be able to raise the voltage to that point again.

Dallas: Insulation breakdown is also defined as a rupture of the insulation which results in the increase of leakage current at the specified test voltage.

Brenner: What is the relationship between insulation resistance testing and high potential testing?

Dallas: We use insulation resistance tests to tell us if insulation is contaminated or to discover things that are wrong with insulation that we can correct. Low insulation resistance may indicate what equipment is wet, dirty, deteriorated, etc. Though this would not necessarily result in breakdown it could result in short life, since current flow through insulation causes an electrolytic action which probably would hasten the ultimate failure. The minimum acceptable insulation resistance has been pretty well standardized as one megohm.

Sidway: The measurement of insulation resistance is affected by the voltage as well as the length of test time. The insulation resistance at the end of one minute, divided by the insulation resistance at the end of ten minutes is known as the polarization index. When the index is less than one half, you can be pretty sure that the insulation is dirty or contaminated, or otherwise defective. Generally, the

higher the polarization index the better the insulation. Temperature of the test also has a very pronounced effect on the measurement.

Miller: Insulation resistance testing is frequently used as a production line sorting test. For example, if 499 out of 500 amplifiers, toasters, or electric irons have a comparatively high insulation resistance while the 500th one has a low value, we throw out the 500th one because we know it is worse than the other 499. There also is a slight relationship between insulation resistance testing and breakdown strength testing (hi-pot testing), in that normally in a given piece of equipment the higher insulation resistance value indicates the ability to withstand higher voltages before excessive leakage current is drawn.

Dallas: These are things that are practically non-existent in any of the insulations that we have to use on aircraft and missile equipment. If you took samples of "Teflon," mica, and polyethylene materials and tried to compare values on the basis of insulation resistance you wouldn't get anywhere, especially since we are dealing with small areas of material that are harder to evaluate. These materials can yield figures of insulation resistance in the neighborhood of 100 to 200 megohms or even much higher.

Brenner: Is insulation resistance or high potential testing better for predicting equipment life, or do they complement each other?

Miller: In general, in tests made on high-production, low-priced types of equipment there is some correlation between insulation resistance and high potential testing. The hi-pot test usually called for is not a real breakdown test but merely the application of a relatively low (500 to 2000 volts) voltage to the equipment, and in one way or another you measure leakage current—whether by means of a leakage light, circuit breaker, or microammeter. You are actually interpreting the hi-pot test in terms of insulation resistance, because naturally, the higher the leakage current the lower the insulation resistance. The equipment specifications will frequently tie you down by calling for one or the other of the tests.

Brenner: For quality control purposes can you get better results by first running an insulation resistance test, then a hi-pot test, then another insulation resistance test, and then comparing the values of the two insulation resistance tests?

Sidway: In testing large machinery we always make an insulation resistance test first, simply to determine if the system is suitable for applying a high potential. The only way we can find out if the system has a specific dielectric strength is to apply the high voltage. If there is no breakdown we are reassured that barring accident or change in operating conditions, the equipment will run until the next time we test it.

Dallas: When a switch is opened or closed the transient voltages developed rise to an exceedingly high value compared to the circuit voltage, and it is one of the main reasons for making hi-pot tests. The purpose of the high potential test is to detect flaws in the insulation, and since most insulations of even a few thousandths of an inch thickness will withstand several thousand volts without being unduly stressed, a test voltage of around a thousand volts or so will not harm healthy insulation.

Sidway: If you make an insulation resistance measurement and find that it is exceedingly low you certainly should not try to apply a high potential test. On the other hand, if the insulation resistance is very high it still does not give any assurance that the structure will pass a high potential test. Since leakage current flows pretty generally over the surface of the insulation as well as through the insulation itself, the effect of a small pinhole which could cause a voltage breakdown may be rather slight in the measurement of the insulation resistance. We have found after making numerous tests that the difference in insulation resistance before and after hi-potting is not much of a criterion.

Question from the Floor: Can you use a hi-pot test to make an insulation resistance test?

Miller: If you are making a high potential test using d-c you can read the leakage current directly on the milliammeter, and at any given instant you can calculate the insulation resistance by using Ohm's Law: $R = \frac{E}{I}$.

Most insulation resistance tests are specified at 500 volts, so all you have to do is raise your voltage to that value and divide the 500 volts by the leakage current to get your insulation resistance. Then of course you can continue raising the voltage until you break the insulation down.

Sidway: The value you get in measuring insulation resistance depends on the test voltage. In one example the insulation resistance measured at 10,000 volts was 3800 megohms; at 15,000 volts it was 2700 megohms; at 20,000 volts it dropped to 2000 megohms; and at 25,000 volts it was down to 1500 megohms. It is quite feasible to calculate insulation resistance while you are making a d-c hi-pot test, and if you do it properly you can get almost any value you choose.

Dallas: For about 75 years the electrical industry has used the figure of one megohm for satisfactory insulation resistance. It is pretty much a rule of thumb. The reason some of the missile people call for high impedances is partially due to inexperience or as a result of less than optimum design.

Brenner: The commonly accepted test voltage in a-c high potential test is twice rated voltage plus 1000 volts. Is this still valid?

Dallas: In the early days of electrical design it was decided that a reasonable surge for switching transients was about 1000 volts. Then if you added twice the line voltage you had a good basis for a high potential test. I believe that is as true today as it was 75 years ago.

Sidway: As soon as a machine is put into service the insulation starts to degrade because of the effects of temperature, time, moisture, vibration, etc. The machines must still withstand the effect of surges, lightning and other high potentials. I concur that the figure is still valid today.

Brenner: In the missile field—especially where we operate with very low voltages of 28 volts d-c, using small components, fine wire, etc.—won't

this application of twice rated voltage plus one thousand cause damage to the equipment? Shouldn't we therefore lower the value?

Dallas: It is a recommendation of the AIEE subcommittee on Aircraft Equipment, Electrical Insulation, that not less than 1500 volts or 1000 volts plus twice line voltage be applied to all equipment. This is to find flaws in the equipment and has nothing to do with wire or component sizes. To put a voltage across a .003″ air gap takes about 1200 volts, but the 1200 volts won't stress .003″ thick "Mylar" at all. It would take 3000 or 4000 volts per .001″. So whether the equipment operates on 2 volts or 1000 volts, the problem remains of finding the flaws in the primary insulation and that requires a sufficiently high test voltage.

Brenner: Can you determine anything from a high potential test using only 100 or 200 volts?

Dallas: You can learn absolutely nothing from a high potential test if the voltage isn't high enough to show flaws in the minimum thickness of insulation.

Brenner: Can we conduct a high potential test that is not damaging but will still yield some valuable information? In other words, does a high potential test have to be destructive to achieve its purpose?

Sidway: The purpose of the high potential test is to find faults in the insulation. The simplest test is the breakdown test, since it gives you the most straightforward answer. In a design test you want to find what value of voltage the insulation system will withstand, so you test it until it fails; then you know it will withstand a little less than the voltage you have applied. It has been our experience that test voltages of about 70 or 75% of the actual breakdown value will not even begin to injure the material during the test. Therefore, the design value of the insulation strength should be well above the value you expect to use in production testing. The length of time of application of the voltage is very important because of an insulation characteristic we will call voltage endurance. It is somewhat akin to the relationship of fatigue tests on metal and their tensile strength. The tensile strength is always higher than fatigue strength, so in our insulation system the short time strength is always higher than the long time strength. Results of many tests indicate that the rate of degradation during d-c high potential testing is considerably less than in a-c tests.

Brenner: If you are conducting an a-c test on a production line and one item has considerably more leakage current than other similar items, would you consider that a defective part or must you actually have a rupture or avalanche of current?

Dallas: It would depend entirely on the values found. The fact that there is a difference in the area below one megohm would be of special significance. You can just breathe on some surfaces, however, and drop the insulation resistance from 100 megohms to 20 megohms. In general, the high values are unstable; so if there is a difference above one megohm, don't pay any attention to it.

Sidway: I concur with Mr. Dallas that a change is significant, although I don't think the values you get are of any importance. If you are running tests on identical parts under controlled conditions and suddenly find a part that is either very high or very low, you know there is something different and you better find out why.

Brenner: If an a-c test is specified, can a d-c test also be used? If it can be used, how do we determine the d-c equivalent of the specified a-c voltage?

Dallas: For aircraft and missile equipment the d-c voltage should probably be about 1.7 x rms voltage. There is no fixed rule to apply, however, and you can find values ranging from 1.4 x rms to 2.3 x rms voltage. In our laboratory we usually use the value of 1.6 x rms voltage.

Sidway: In general, when we talk about a double voltage plus 1000 volts test we are referring to the one minute hold test. In other words, the voltage is brought up to the predetermined value and held for one minute. If you compare the d-c breakdown voltage to the one minute hold value, or compare it to rapid rise value, you will get a different ratio. The d-c test will not stress the material in the same way that the a-c does. Since most materials are not entirely homogeneous you have several dielectrics in series. With a-c, the voltage is divided across the structure in proportion to the dielectric constant of the material; while with d-c, the voltage is divided in proportion to the resistance of the material. The various sections of the material are therefore stressed differently with d-c than with a-c, since the dielectric constant does not necessarily correlate with the insulation resistance. Experience shows that imperfections, such as an actual air path, hole, or crack, will yield similar results with the 1.4 ratio between d-c and a-c. Cable manufacturers' specifications usually call for a ratio of 3 to 1, however. We have found over the years that using a direct voltage of 1.8 x a-c value has given us good results. The generally accepted rule of thumb, however, is that you should use a value of 1.6 to 1.7 times the prescribed a-c voltage.

Miller: While I agree fully with Mr. Sidway that the 1.6 to 1.7 times the a-c value is a logical choice, some specifications call for voltages of 1.1 x rms value, which is about the lowest correlation you might come across. An often specified value of 1.6 x a-c voltage for new equipment frequently is dropped to 1.1 x a-c value for older machines.

Dallas: Equipment which passes a d-c test may subsequently fail with an a-c test, since with a-c you are causing electrostatic motion of twice the applied frequency on any thin insulation sections which can move. This causes a very high stress which you don't get when using d-c. Although we frequently use d-c in aircraft missile testing, especially in large cable where it is much more convenient, we also use it with the full recognition that we have to use a higher voltage than the figures mentioned here.

Sidway: I might add that in a-c testing there is also a dielectric heating effect that in itself may lead to breakdown. A cyst or air inclusion in the insulation system may also be more readily found with an a-c breakdown test, since the distribution of voltage may cause internal corona in the void.

Brenner: Why would we want to use

d-c rather than a-c, which is the relatively established standard for high potential testing?

Miller: We recommend d-c testing wherever possible because it gives more of a qualitative rather than a go-no-go method of indication. With a-c testing you run the voltage up to a prescribed value and equipment either passes or doesn't pass the test. Failure is usually indicated by means of a circuit breaker, neon light, or any of the many other ways you can indicate leakage current or breakdown current. With the d-c test, as you gradually raise the voltage, you meter the leakage current and as long as the leakage current is climbing roughly at the same rate as the voltage, you know that the insulation is holding up. In many cases you can anticipate breakdown by observing the sudden increase in the slope of the current vs. voltage curve (called a knee). By stopping the test voltage short of the avalanche current that occurs with breakdown you can avoid damaging the equipment, but still get a good indication of the voltage at which breakdown will occur. Furthermore, with d-c testing, since you are metering the current, you can determine the leakage at any particular voltage; while with a-c testing the only indication you have is when the leakage exceeds the preset amount that triggers the leakage alarm.

Dallas: If you have a defect in the insulation, there is no reason to worry about destructiveness of the high potential test designed to detect flaws. Even if you could approach the flaw and stop you wouldn't actually want to stop, so I don't know why people testing aircraft equipment would want a so-called non-destructive test. As a matter of fact, when you are looking for a fault in the equipment you want to burn it in so you can find the exact spot where the insulation failed; therefore, a go-no-go test is exactly what you want.

Miller: The equipment being tested is the prime factor. The manufacturers of washing machines, radios, etc., wouldn't concur with you. I'm sure Mr. Sidway wouldn't want to destroy one of his 50,000 kva generators because of a potential flaw. The matter of being able to approach the breakdown point without destroying equipment leaves it up to the test engineer to determine the most appropriate time for taking the equipment out of service for repairs.

Sidway: In plotting leakage current against voltage you have to be careful, because you can get a false indication or a false interpretation of the knee in the curve. In one test we ran we suddenly got a knee at about 28,000 volts, and further investigation indicated the rapid rise of leakage current was due to corona from the test lead. As soon as the lead was replaced with a heavy shielded wire we were able to run up to 40,000 volts. In other cases where machines suddenly broke down without any sign of the knee, we found the nature of the fault was frequently a hole in the insulation. The voltage vs. current curve was smooth until the corona voltage of the hole was reached, then the sudden ionization of the air gave an immediate breakdown. In other words, you can sometimes predetermine the point at which failure will occur, but not always.

Dallas: With some of the newer insulations, that "not always" can be reworded as "very seldom." In the missile field we usually get breakdowns simultaneously with any large increase of current flow, whether it be a-c or d-c. It is almost impossible to detect breakdown just before it occurs.

Brenner: What is the principal advantage of using direct current?

Miller: In addition to the technical advantages we previously mentioned, there are sound economic reasons. I can give you a few examples to pinpoint this. On smaller equipment, that is, around 1000 to 5000 volts, d-c test equipment is a little more expensive than a-c equipment, primarily because of the more complicated metering circuits usually included. As we increase the voltage the cost of the a-c equipment goes up much faster than the d-c equipment, so that by the time we reach the 30,000 volt range the a-c equipment gets more expensive than d-c. By the time we get to about 100,000 volts or so, a-c equipment costs several times that of d-c and weighs several times as much. The a-c machine has to supply the capacitance current which gets to be considerable in the large units, while the d-c machine has to supply only the leakage current, with a little left over for stray currents.

Brenner: What are the differences in technique between a-c and d-c testing? How would you perform the test? Is the indication of failure the same in both cases?

Miller: Here again the type of equipment under consideration dictates the answer. The bulk of the miscellaneous low priced equipment such as household appliances, general consumer goods, etc., is almost universally tested with a-c; that is, low voltage a-c testing with a preset leakage light setting that will indicate leakage of more than ½ milliamp. With equipment that has higher capacitance, the leakage light setting is arbitrarily raised to a point where it will not glow for good units but will glow for poor units. The test voltage usually required by Underwriters or NEMA is twice rated voltage plus 1000 volts. Voltage is momentarily applied between live and grounded sections of the appliance. If the leakage light glows the unit is thrown aside for repair, and if it doesn't glow the unit is good and is passed. That's the way it is done in one field. Where specifications such as those set up by ASTM are required, a more rigorous procedure is followed. ASTM doesn't seem to recognize d-c testing, so any reference to an ASTM specification automatically means a-c. ASTM specs are also go-no-go type tests. In the rate-of-rise test, the voltage is raised at a preset speed which may vary from 500 volts to about 3000 volts a second, depending upon the material and specification. The test is made by raising the voltage either to a predetermined value or until the specimen breaks down. In the step-by-step method the voltage is raised in discrete steps, each value being held for a fixed interval of anywhere from a few seconds up to a minute or more, depending upon the specification. Here again the voltage is raised either to the predetermined value or until the specimen breaks down. Another type of a-c test is in the nature of

an endurance test where the voltage is held at a fixed value for an interval from a minute in some applications to a day in others. The voltage is then raised by fixed amounts and the test continued. In d-c testing the voltage is also raised by discrete amounts. At each step, sufficient length of time is allowed for the leakage current to settle down and then the voltage and the current are read and plotted. The voltage is raised up to the limits set by the specification or manufacturer or until it is anticipated that material is about to break down or even until it actually does break down, depending upon the purpose of the test. A second but not quite so common test is that of applying a preset voltage and if the equipment shows a leakage current of less than the predetermined value, the equipment is accepted; while if it is higher than that value, it is not accepted. There are about as many detailed methods of testing as there are manufacturers and testing agencies.

Brenner: What is the effect of sudden vs. gradual application of voltage?

Sidway: The rate of application affects the value you get. Most of the standards for machine testing call for application of twice rated voltage plus 1000 volts for one minute. Normally you would bring the voltage up at the rate of about 1000 to 3000 volts a minute to at least 60% of the final voltage, then raise it as quickly as you can to the final voltage. The important thing to remember is that most of the destructiveness of an a-c test occurs after the voltage has reached 70 to 75% of the breakdown strength. All the other methods Mr. Miller mentioned are used in design work or development work in developing these voltage endurance tests. When the voltage is applied to a specimen in a few microseconds we have what is called an impulse test. The breakdown strength in that type of test is quite high. As the length of time of application increases, the breakdown strength lowers.

Dallas: It is usually desirable to apply the test voltage slowly to the extent that an indication of breakdown will be an immediate signal to the operator to reduce the test voltage. The test voltage may also be applied and removed instantly, although this is a rather controversial subject. We've never been able to find evidence of any surge appearing across the equipment if we applied the voltage from the source directly to the equipment.

Miller: We have two objections to applying the high voltage suddenly. First is that of operator safety, since many times unskilled help handle the high potential test leads. This can often be adequately safeguarded so that it becomes a minor factor. The second objection is that of potential damage to the test equipment itself. The equipment being tested usually is slightly capacitive, so that at the initial application of high voltage it represents a short circuit. In the instant prior to making contact between the high potential lead and the subject, a large arc can be drawn, depending of course upon the speed of application of the test lead, the preset voltage, and the current capabilities of the machine. This arc sends out a strong RF surge through the test equipment, and a considerable amount of research was expended to develop adequate means of protecting the meter diodes and other sections. This RF surge usually results in a much higher voltage than that of the test being run. In addition, the high frequency often can burn out parts of the equipment where a 60 cycle surge will not have any effect.

Brenner: What about the effect of successive applications of high voltage? What is the effect on the output failure point of the specimen when several hi-pot tests are made in the course of its manufacture, inspection, and maintenance? If there is an effect, is there any difference in using a-c or d-c?

Dallas: Since we are extremely weight conscious in the missile field, we have to design equipment using the absolute minimum insulation to do the job. If you plot the length of time the material will withstand a given voltage against the voltage, you will find that the breakdown time increases rapidly with a decrease in voltage. In fact, when you get beyond the one hour breakdown point, a very small percent of decrease in test voltage will increase the life of the insulation a very long time. We therefore pick insulation that can withstand 1500 volts for an hour, so we are able to apply a large number of tests at that voltage without seriously deteriorating the insulation in the least during the test process. For example, 10 one minute tests will reduce the life of the insulation a very small amount. The AIEE test code which calls for a 1500 volt high potential test also calls for a 20% reduction in the high potential test voltage on repeated tests, or for service and maintenance tests. Because of the shape of the withstand time vs. voltage curve, if you go beyond the one hour point you actually can withstand hundreds of hours of testing at a 20% reduction of voltage. That means the number of re-tests that can be conducted is almost unlimited.

Sidway: I agree with Mr. Dallas but further point out that equipment manufacturers take this into account. For example, during the manufacture of a machine the wound coils are given a one minute, 60 cycle test at 135% of the final test voltage (double operating voltage plus one thousand volts). After the coils are placed in the slots they are again tested by rapidly raising the voltage to the test value and reducing it quickly. This test is made at 126%. Then, after the core and connections are taped and the winding is brought out, it will be given another rapid rise test of 116% of the double plus a thousand volts. When the winding is finally completed and reaches the test floor, it is given a one minute test at the double plus 1000 voltage. So you see in the fabrication of ordinary power equipment there is a degrading of test voltages from the time the coils are made until we make the final test. Insulation systems are so designed that none of these tests encroach on the integrity of the insulation. We have applied the one minute test repeatedly, hundreds of times, without any measurable change of quality of insulation.

Brenner: Is there anything that specifies decreasing the voltage rating in successive tests to prevent damage to insulation?

Dallas: We believe a manufacturer should do his testing at a voltage higher than the 1500 volts recommended by the aircraft industry by an amount sufficient to take care of the differences in tolerances between the meters in the manufacturers' test equipment and the customers' test equipment, line voltage surges, etc. He should add at least 15% to the test voltages. In other words, by having the manufacturer test the equipment at 1800 to 2000 volts while it is going through assembly the customer can safely apply 1500 volts test.

Brenner: Another subject tied in with testing is the effect of time on the application of voltage. In other words, why should you apply the voltage for one minute rather than one second . . . or even an hour?

Sidway: The voltage endurance periods of insulation vary with the material. You must first establish a knowledge of the dielectric properties of the material you're working with. Once you know the endurance characteristics which tell you how the dielectric stress varies as a function of time, you are in a position to fix the test values. Your system in the first place must be designed to have adequate strength; then if you test at 75% of this maximum strength, repetitive testing will not cause any damage. In other words, fears of making tests in fairly well designed systems are groundless. You cannot build a mechanically sound insulation system in which insulation is so thin that you can use a test voltage of less than 1500 volts with any assurance. Many other things hurt the system more.

Brenner: When making an endurance test, do you get the same effect if you apply the 1500 volt test potential for one minute 10 times as you would if you applied the voltage one time for 10 minutes?

Sidway: There are three main causes of insulation breakdown. Failure may occur if the current flowing through the insulation is so high the dielectric losses heat the material. Another type of failure is caused by internal ionization. The third type of failure is caused by actual electronic disintegration, as in the case of impulse testing. Generally, thermal failure occurs when the copper is run hot, which in turn heats the insulation. It is seldom caused by leakage current heating the insulation. Most of the failures we have to deal with are caused by ionic disintegration, and there it is possible to have accumulative injury if the test voltages are high enough. However, we have stressed that you should do your testing at voltages well below the predetermined ultimate strength so you will not get into the thermal or ionic disintegration range. When that is the case, it doesn't make any difference whether you apply a one minute test with rest periods 15 times or apply the same test for 15 minutes without rest periods. It is only when you are working with a value of leakage current sufficient to cause heat that cannot be radiated that the rest period becomes sensible. In many equipments we have made repetitive tests with the rest periods and have made other tests leaving the voltage on the machine for weeks at a time, and have found no changes. It is necessary to understand the area you are working in and what the nature of the destruction is, and then you can judge whether repetition is going to give you accumulative trouble.

Brenner: What is corona? What is its effect? And why do you have to worry about it when you are testing?

Sidway: There are at least two kinds of corona effects. First is the superficial corona we get due to the dielectric stresses on the surface of the equipment being tested. There, you often can see long streamers or other visible display. While this external corona does no harm, it plays havoc with any current measurements you are trying to make, because the corona currents are usually very high. The other type of corona that we do have to worry about is the corona that forms within the equipment. This corona can disintegrate insulation and exhibits an accumulative effect. Corona can be present at surprisingly low voltages. You can have serious corona problems at 4000 volts, and I've known cases of corona trouble in motors operating as low as 480 volts. Some materials are much more susceptible to corona than others. "Mylar" film in some forms is particularly sensitive.

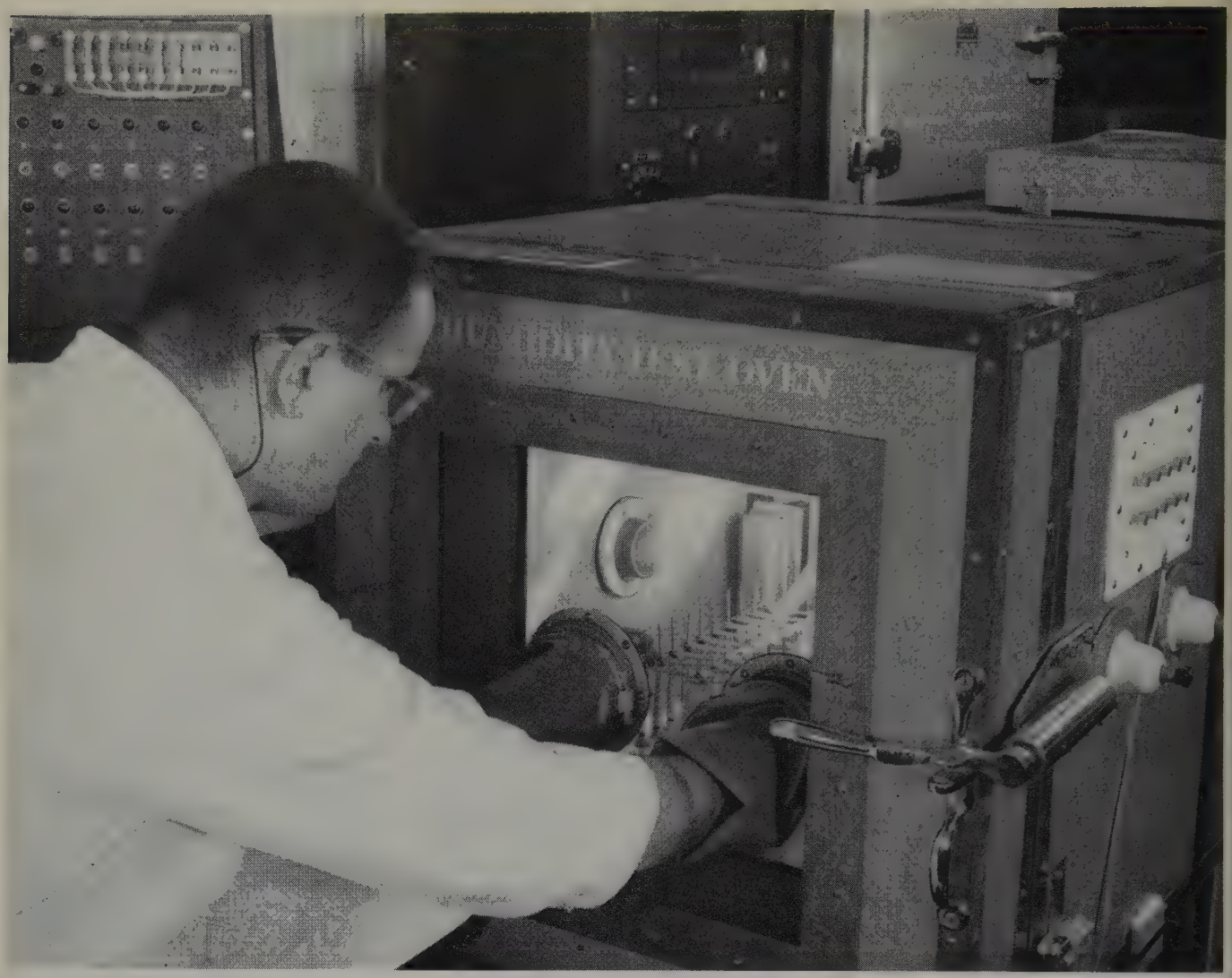
Dallas: Corona has a strong effect on missile equipment. You can sometimes lose 20% of the effectiveness of some insulating materials after a five second exposure to corona. Essentially, corona is ionization of the air due to the high voltage, and when the air disassociates you get a bombardment of the insulation material. This doesn't affect mica too much although it will eventually erode it, but it erodes "Teflon" and "Mylar" materials very rapidly. You can get serious destruction of insulation due to field concentrations even in those cases where we can't measure the presence of corona by orthodox means.

Sidway: There is a definition of corona that describes it as a luminous discharge due to ionization of the gas around the conductor which exists when the voltage range exceeds a certain critical level. This level is the corona starting voltage and it becomes lower and lower as the atmospheric pressure decreases, so that a machine that is well designed at ground level may not work at all at higher elevations.

Brenner: In specifying high potential tests it is important to indicate the voltage, the rate of rise of that voltage, how long the voltage should be applied, and most important, what constitutes failure. Regarding failure, is there a maximum amount of allowable leakage current, or should you wait until the circuit breaker pops, should you look for arcing, or just what determines whether or not the product is acceptable?

Dallas: In testing a specific item I think either a definite leakage value or circuit breaker setting should be specified.

Sidway: The frequency of the test voltage should also be specified, since a test made at 60 cycles will give you a higher breakdown value than one made at one kilocycle. We only consider failures that are real breakdowns; that is, where we get a very high change in current flow and where we cannot raise the voltage again to the previous value. The circuit breaker should be set high enough so you actually puncture the insulation before the breaker goes.



Insulation of "Mylar" gives capacitors longer-lasting stability under high humidities

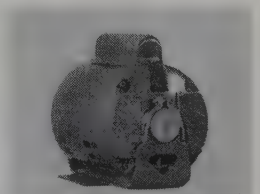
Punishing, hot, humid atmospheres like those in the test chamber above have little effect on capacitors insulated with "Mylar"* polyester film. These capacitors have remarkable stability and longer life, because "Mylar" is much less sensitive to high temperatures, changing humidity and aging than other commonly used insulating materials.

Capacitors made with "Mylar" meet the highest standards of reliability, yet are frequently smaller and less costly than other units. Thinner insulation can be used, because of the exceptionally high dielectric strength of "Mylar". And "Mylar" reduces the need for costly encapsulation because of its remarkable resistance to moisture.

Whether you manufacture or buy electrical products, you can get improved performance with "Mylar". And, figured on a square-foot basis, "Mylar" will often cost you less than your present material. For full facts on "Mylar", write for free booklet. E. I. du Pont de Nemours & Co. (Inc.), Film Department, Rm. No. 14, Wilmington 98, Del.

Tough, thin "Mylar" has this unique combination of properties for superior insulating performance:

- Average 4,000 volts per mil dielectric strength (Per ASTM D-149). Average power factor of 0.002 at 60 cycles.
- Thermal stability from -60°C to Class B range.
- Chemical and moisture resistance.
- Resistance to aging, abrasion, tearing and rotting.



IN MOTORS— Insulation of "Mylar" cuts size and weight, improves moisture resistance . . . at no increase in cost.

*"*Mylar" is Du Pont's trademark for its brand of polyester film.*

DU PONT
REG. U.S. PAT. OFF.

Better Things for Better Living . . . through Chemistry

DU PONT MYLAR® POLYESTER FILM

Print Ins. 28 on Reader Service Card

Utilization of Plastics Potting and Casting In Aero-Space Industries

By M. F. McFadden, Head, Materials & Process Section, Raytheon Co., Missile Systems Div., Bedford, Mass.

Abstract

A report is presented on the extent to which plastics potting and casting processes are utilized in aero-space industries. The report is based on the results of a survey of 35 representative companies.

The relative utilization of company-formulated vs commercial-ready-mix compounds is set forth. Kinds of resins, fillers, and curing agents are tabulated. Efforts to achieve fixed values for certain physical and electrical properties of cured potted and cast plastics are discussed. Graphs are presented indicating the need to develop extended property values.

The status of "company proprietary" specifications is discussed together with the expressed need for more uniformly standardized government or commercial specifications.

Introduction

Plastics potting and casting in the aero-space industries is not a new art. Unbelievably complicated and intricate electronics equipment plays a significant role in the functioning of aero-space vehicles. To assure reliability of such precisely engineered equipments, extensive use is made of plastics for potting and casting.

In the past five years, the art of formulating and processing plastics for such applications has become relatively refined. However, standardized specifications for these materials and processes are still relatively nonexistant. Such lack of unified specifications poses a real problem in an otherwise fast moving industry.

To determine the needs, and what can be done about this specification problem, 35 representative aero-space industries were surveyed. Detailed findings reveal some interesting facts.

Company Formulated vs Commercial Ready-Mix Compounds

Figure 1 shows the relative use of company-formulated compounds vs commercial ready-mix two-part compounds.*

Only two of the surveyed companies formulate the majority of their plastic potting and casting compounds; 46% of the companies do formulate a few; 48% do no formulating at all.

Commercial ready-mix two-part compounds are used by 71% of the companies for the majority of their potting and casting applications; 20% of the remaining companies, however, do use commercial mixes for a few of their potting and casting applications. The remainder do not utilize any commercial mixes for their potting and casting.

Kinds of Plastics

Resins

Epoxy resin is the most widely used, both for company-formulated compounds and as the base resin in commercial ready-mix compounds. Figure 2 shows the most generally used resins. For a large part of their potting and casting applications, 83% of the companies use epoxy, 60% use silicone, 57% use polysulfide and 31% use polyester. Approximately 59% of the epoxy users utilize this

"Company-formulated compounds" are considered to be those where the company develops a formula consisting of base resins, catalysts, extenders, fillers and/or other necessary ingredients; together with a developed procedure for potting or casting. "Commercial ready-mix two-part compounds" are considered to be two-part packages of proprietary commercially marketed plastics, designed for ready use immediately upon adding the catalyst or hardner.

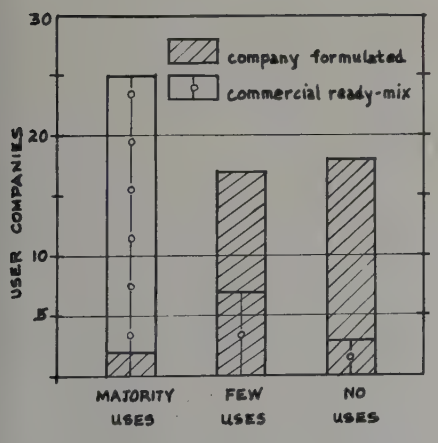


Figure 1, relative status of plastic potting and casting compounds in use.

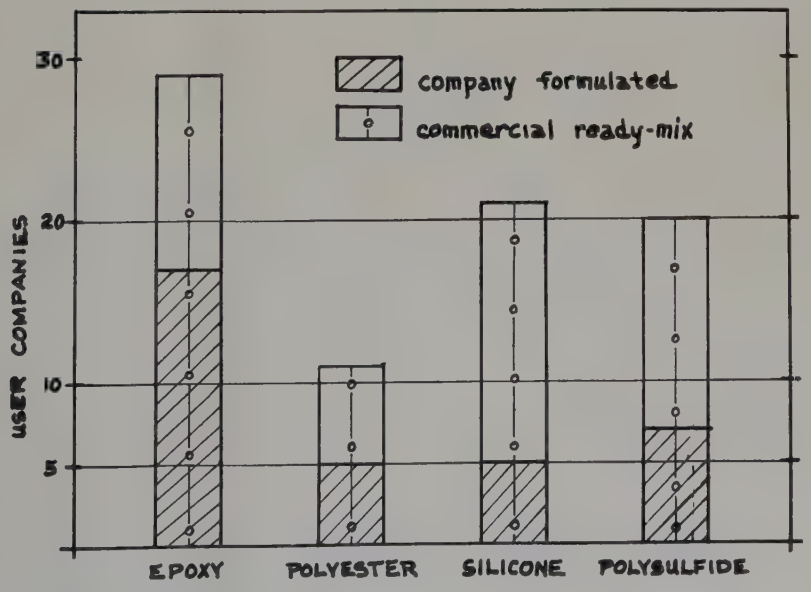


Figure 2, kinds of resin in use in various companies.

Table 1—Curing Agents

Curing Agents	Co-Formulated Most	Co-Formulated Least	Comm. Ready-Mix Most	Comm. Ready-Mix Least
cobalt napthenate	X			
diaminopymdine			X	
dicyandiamide	X			
diethylamine	X		X	
diethylene triamine	X		X	
ethylene diamine			X	
metaphenylene	X		X	
methyl ethyl ketone peroxide	X		X	
piperdine	X			
pyridine	X		X	
tetraethylene pentamine	X		X	
tri-deiethyl-aminomethyl-phenol	X		X	
triethylamine	X		X	
benzoyl peroxide		X		X
dichromates				X
diethylaminopropylamine		X		
lead dioxide				X
lauroyl peroxide		X		
methyl-diethanolamine		X		
methyl nadic anhydride		X		
methylene bis-orthochloroaniline		X		
polyamine		X		
pyromellitic dianhydride		X		
sebacic anhydride		X		

Table 2—Fillers

Fillers	Co-Formulated Most	Co-Formulated Least	Comm. Ready-Mix Most	Comm. Ready-Mix Least
aluminum powder	X		X	
glass fibers	X		X	
mica	X		X	
silicon dioxide	X		X	
talc	X		X	
alumina		X		
asbestos		X		X
bone black		X		
calcium carbonate		X		
ceramic powder		X		
glass beads		X		
iron dioxide				X
lithium-alumino-silicate		X		
micro balloons		X		
quartz		X		
steel				X
titanium dioxide		X		
walnut shells		X		

resin in company-formulated compounds, but only 24% of the silicone-users utilize silicone for company formulating.

Fillers

Fillers in use are shown in table 2. Mica, silicon dioxide, glass fibers, aluminum powder, and talc are the most frequently used fillers for both company-formulated and company ready-mix compounds. With the exception of asbestos, iron dioxide, and steel, the remaining 13 less frequently used fillers are utilized in company-formulated compounds only.

Curing Agents

Catalysts, curing agents, and hardeners in use are shown in table 1.

There are 13 curing agents in frequent use. With the exception of triethylamine, piperidine, and diaminopyridine, these agents are used for curing both company-formulated and commercial ready-mix two-part compounds. The remaining 13 less frequently used agents are utilized primarily for curing company-formulated compounds.

Properties of Cured Plastics

Physical and Electrical Properties

Considerable interest was displayed in end-use properties of cured plastics, particularly for water absorption, electrical resistance, and temperature stability. Figure 3 shows the relative need for fixed-values for certain physical and electrical properties.

There were 78% of the companies which reported they require established values for water absorption, electrical resistance, and temperature stability. Only 49% of these companies, however, have developed such fixed values for all of their plastic potting and casting applications. And 10% have no fixed values at all for these particular properties.

More than half (56%) of the companies reported they also require established values for impact, compression, tension, flexure, dielectric constant, coefficient of thermal expansion, and the maximum heat distortion. Only 25% of these companies, however, have developed such fixed values for all of their plastic potting and casting applications. And 14% have no fixed values at all for

these particular properties.

End-Use Temperatures

All companies are concerned about the properties and characteristics of cured plastics at end-use temperatures. Approximately 31% have need to know the properties at the end-use temperatures from —65°F through +350°F, 29% need properties at temperatures from —65°F through +500°F, and 23% have need for properties up to +600°F. Another 2% of the companies require properties from —65°F to +1000°F.

Figure 4 shows the specific interest in end-use temperatures for which properties have been, or should be, established.

Dependability of Property Values

Twenty-nine of the thirty-five companies reporting have established fixed values for many of the end-use properties needed in their applications of potted and cast plastic. Sixteen of these companies believe their values are sufficiently dependable to be utilized as a basis for initiating universally standardized specifications.

In the case of twenty-eight companies, however, it was reported that in those cases where property values have not been established, they control the quality of cured parts by (1) precise duplication of workable formulas and (2) process monitoring on

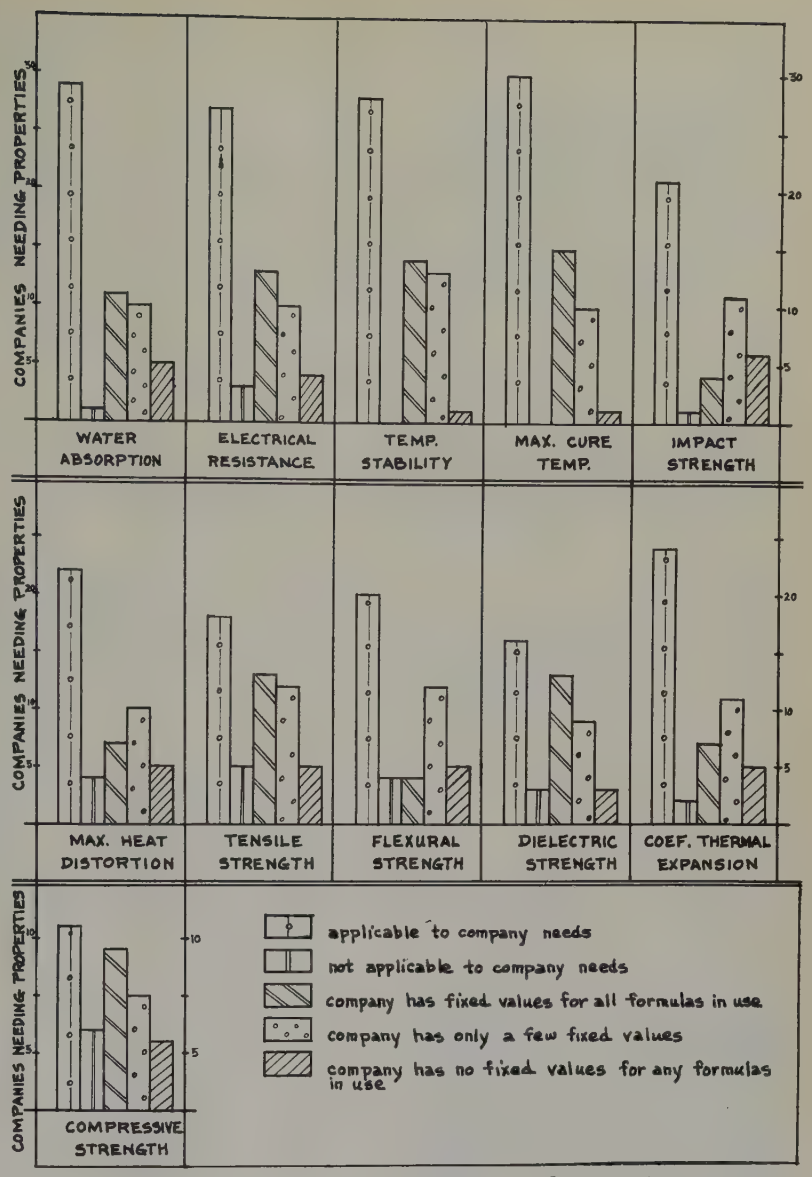


Figure 3, relative status of physical and electrical properties.

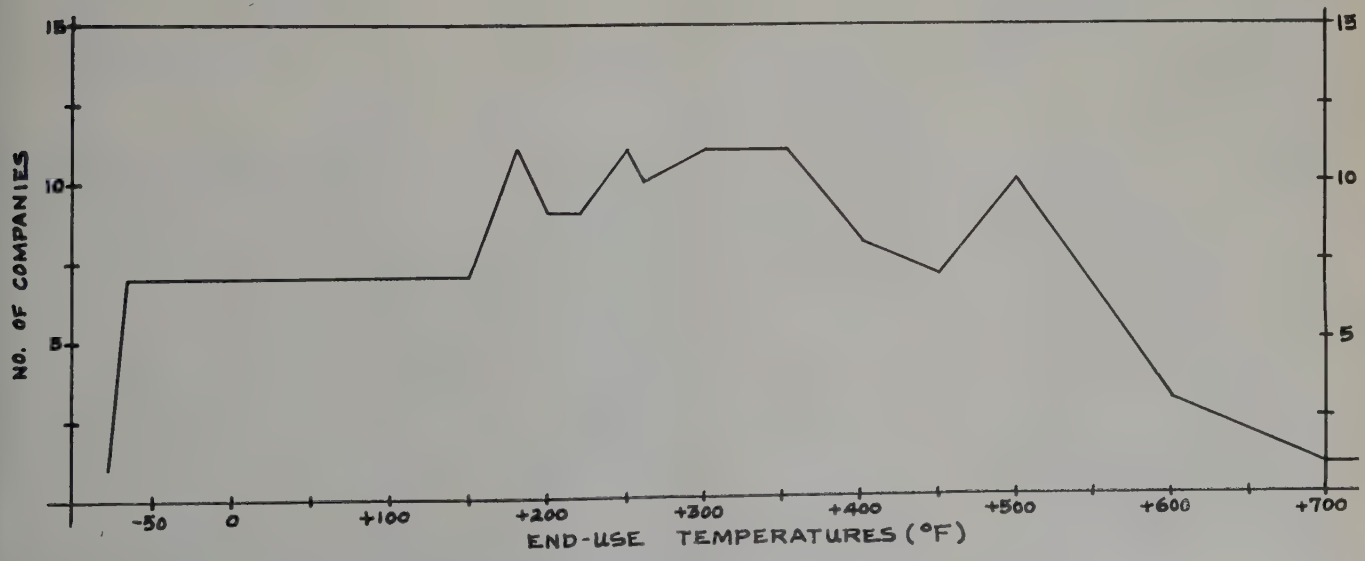


Figure 4, end-use temperatures of plastic potted and cast parts.

the basis of "follow the formula and procedure carefully."

Need for Specifications

Specification Possibilities

Three possibilities, or combinations thereof, could be used in implementing universally standardized specifications for the most frequently used plastic potting and casting processes. These could be of the following nature.

(a) Material Specification — Separate material specifications for each unique item contained in the formulas for company-formulated compounds.

(b) Material Specification — Separate material specifications for each unique composite two-part compound (one part to be resin mixture and one part to be curing agent), whether it be a company-formulated compound or an available commercial ready-mix.

(c) Process Specification — Separate process specifications for each combination of end-use properties, whether it be a company-formulated compound or an available commercial ready-mix.

Types of Specifications Preferred

All companies reporting desire universally standardized specifications for the most frequently used potting and casting processes; 66% prefer two-part material specifications only (this proportion coincides readily with the proportion of companies in figure 1 who use commercial ready-mix compounds, instead of formulating their own). However, 33% of the reporting companies also prefer process specifications, regardless of whether their casting and potting materials are company formulated or commercial ready-mixes. And 10% of those preferring process specifications also prefer material specifications for each unique ingredient contained in the company-formulated processing formula.

Implications of "Company Proprietary" Specifications

Only five companies consider their specifications for plastic potting and casting to be "company proprietary" to the extent that they would not wish to disclose their company specifications for purposes of compilation and initiation of universally standardized specifications. In general, these five companies considered their formulas to be the proprietary part of their specifications, with less accent on the procedures for potting, casting, and curing.

Summary

Approximately three-quarters of the reporting companies use commercial ready-mix compounds for the majority of their plastic potting and casting. Relatively few companies formulate the majority of their casting and potting compounds. Nearly half the companies do, however, formulate a few.

Epoxy is the most generally used resin. Silicone, polysulfide, and polyester resins are next in respective use. Fillers of mica, silicon dioxide, glass fibers, aluminum powder, and talc are used extensively.

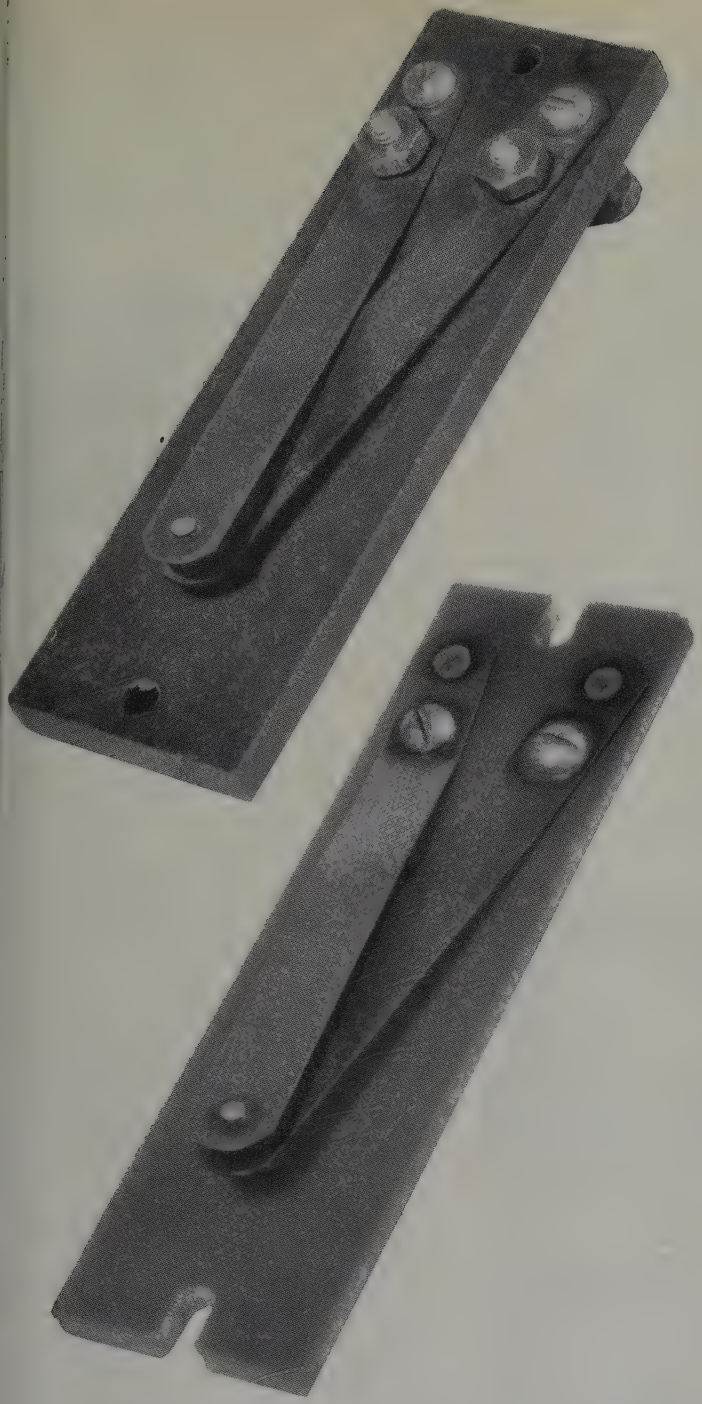
In many cases only scattered and isolated physical and electrical property values have been established for cured potted or cast plastic. Approximately one-half of the companies have, however, developed fixed values for water absorption, electrical resistance, and temperature stability for their applications. Only one-fourth of the companies, however, have values for other electrical and physical properties, although extensive need for these values was displayed.

End-use temperatures, of interest, range from —67 to +1000°F, with the majority having need for property values in the range of —65 through +500°F.

Extensive interest was displayed in initiating universally standardized specifications for the most frequently used plastic potting and casting. Relatively few considered their company specifications sufficiently proprietary as to preclude their use as basic tools for preparing universally standardized specifications.

Acknowledgement

The author wishes particularly to express appreciation to the many fellow members of the Aero Space Materials Division of the SAE Technical Board, and to their respective employers, for making this data available.



HOW TO PUNCH HOLES IN HIGH PRODUCTION COSTS...

The original production of this switch base (left top) called for sawing on 4 sides, drilling 7 holes and affixing 4 screws and nuts. Spaulding reduced these operations at a saving of 75% by re-designing the part (left bottom) and using a grade of Spauldite that can be punched and extruded.

...WITH SPAULDING VALUE ANALYSIS ENGINEERING

The Value Analysis process calls for a "scientific method of accomplishing a function at the lowest possible cost."

That is why Spaulding maintains staffs of specially trained engineers who evaluate a customer's product, then show how it can be made better, easier and at a lower cost with a Spaulding Material, processed by Spaulding's own Fabricating Department.

The unique characteristics of Spaulding Industrial Plastics and Vulcanized Fibre hold the same advantages for **your** product.

SPAULDING FIBRE COMPANY, INC.

399 WHEELER STREET, TONAWANDA, NEW YORK

free VALUE ANALYSIS BROCHURE

SEND FOR YOUR COPY NOW

SPAULDING FIBRE COMPANY, INC.
399 Wheeler Street
Tonawanda, New York

Please send a free copy of the brochure, "Spaulding Value Analysis."

Name .....

Firm .....

Address .....

City ..... Zone ..... State .....

Print Ins. 31 on Reader Service Card

People in the News

At Robertshaw-Fulton Controls Co., *Robert L. Wehrli*, vice president and general manager of the Aeronautical and Instrument Div., Anaheim, Cal., will move to Richmond, Va., as vice president and assistant to the president of the corporation. He will be succeeded by *Raymond H. Heller*, previously director of field engineering and sales for the Aeronautical and Instrument Div. *Charles H. Unruh*, advertising manager of the Anaheim Div., will assume Mr. Heller's previous duties.

Ivan J. Barclay and *Robert R. Cope* have been appointed general sales managers of Rea Magnet Wire Co. Inc., a division of Aluminum Co. of America, Fort Wayne, Ind. With the company since 1940, Barclay will be responsible for the sale of copper magnet wire and Cope, who joined Alcoa in 1946, will direct the sale of aluminum magnet wire and aluminum foil and sheet strip conductors. Other developments at Rea: *Ben Miller*, formerly chief design engineer, and *Evert A. Mol*, formerly research director, have been named assistant technical directors, and *Robert W. Fay* was appointed manager of industrial and public relations.

R. R. Cope

I. J. Barclay

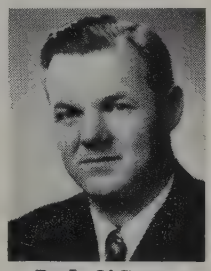
E. A. Mol

B. Miller

Lloyd E. St. Jean, chief engineer in the equipment design department of Sanders Associates Inc., Nashua, N. H., has been named general manager of the company's new facility in Plainview, L. I., N. Y.

Robert F. Lamberton, formerly with Spaulding Fiber Co., has joined Northern Plastics Corp. as regional sales manager for the company's Industrial Div., with headquarters in LaCrosse, Wis.

Dan J. O'Conor, Jr., president, Formica Corp., Cincinnati laminated plastic producer, has been elected a vice president of the parent firm, American Cyanamid Co. He will be responsible for Formica Corp. and Cyanamid's Plastics and Resins Div., Wallingford, Conn. *Walter A. Smith*, former assistant general manager and vice president, has been named executive vice president of Formica Corp.



D. J. O'Conor

W. A. Smith

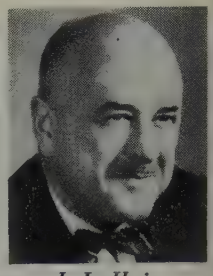
David M. Murray, secretary-treasurer, has been elected a director, and *Reginald C. Whitson* has been elected a director and vice president-marketing at Hysol Corp., Olean, N.Y., insulating compound producer. Hysol's director of research and development, *Dr. Cataldo Ciadella*, has been elected a director by Hysol (Canada) Ltd.

Babcock Electronics Corp., Costa Mesa, Cal., has appointed *Donald A. Gehlke* as vice president, corporate director of advanced development.

At Consolidated Systems Corp., Monrovia, Cal., *John B. Mandle* has been promoted to assistant director of operations. *Clyde V. Musty* succeeds him as manager of quality assurance.

Edward B. Maire, formerly general manager of Robertshaw-Fulton's Mairco Division at Goshen, Ind., has been named general manager of Robertshaw's Bridgeport Thermostat Division at Milford, Conn., and assistant vice president.

E. B. Maire



J. L. Heins

John L. Heins, formerly vice president, engineering, G. B. Electronics Corp., has joined Servo Corp. of America, Hicksville, N.Y., as director, defense systems.

John W. Paterno, former project engineer, has been appointed a technical representative in the Metropolitan New York sales region of Union Carbide Plastics Co., Div. of Union Carbide Corp., with sales responsibility for phenolic, epoxy, and vinyl resins.

Continental-Diamond Fibre Corp., Newark, Del., insulation material manufacturer, has appointed *Robert M. Whitman* a cellulose chemist, and *Roger L. Smoot* a research engineer in the laminate research section.

Martin H. Adelman, Jordan E. Dannin, Anton Jurecic, George J. Kollman, and *Paul J. McGonigal* have been named research chemists, while *Dr. Alberto Malatesta* has been appointed a research group leader in the central research laboratories of the Borden Chemical Co., a division of the Borden Co.

The Resins and Chemicals Div. of the Jones-Dabney Co., a division of Devoe and Raynolds Co. Inc., Louisville, Ky., has opened three new sales territories with *R. T. O'Connor* in New England, *R. L. Wheeler* in the Midwest, and *G. V. Jenks* in Los Angeles.

William A. Rowley has been named sales manager of all plastic products for Geauga Industries, Middlefield, Ohio.

Francis H. Anderson has been appointed superintendent of the El

Segundo, Cal., works of Allied Chemical Corp.'s General Chemical Div. The El Segundo works was recently enlarged to provide production facilities for electronic chemicals.

Robert M. Schlenker, former production manager for NJE Corp., has been named vice president of PRL Electronics Inc., Rahway, N.J.

R. M. Schlenker

A. Campbell

A. Campbell, Jr., with the firm for 23 years in various sales and customer service capacities, has been promoted to manager of sales and marketing services for the Thermoid Div., H. K. Porter Co. Inc., Trenton insulation manufacturer.

Arthur W. Steudel, president of Sherwin-Williams Co. since 1940, has been elected chairman of the board and chief executive officer, a post vacant since 1944. *E. Colin Baldwin*, formerly vice president and general manager of the Cleveland firm, succeeds Steudel as president.

E. W. Jones, currently field sales manager, has been appointed manager of industrial adhesives sales at the Industrial Div., Armstrong Cork Co., Lancaster, Pa.

FXR Inc., Woodside, N.Y., manufacturer of microwave instruments, has appointed *Stanley Lehr* and *Robert E. Othmer* as engineering section heads.

S. Lehr

R. E. Othmer

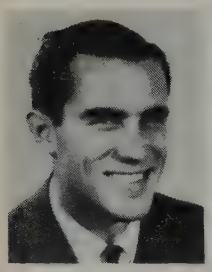
William A. Tweedie, formerly senior operations analyst of the management science department of Stanford Research Institute, has been appointed vice president in charge of operations

of Ling-Temco Electronics, Ling Electronics Div. of Los Angeles.

Louis P. Deis has been named manufacturing superintendent for AviSun Corp.'s film and fiber plant, New Castle, Del., polypropylene producer. At the executive offices in Philadelphia, *Henry E. Wessel* has been named manager of sales planning.

Harold White has been appointed Michigan-Indiana district sales manager for Fasson Products, Painesville, Ohio, supplier of self-adhesive papers, foils, and films.

Harold Deck has joined Components for Research Inc., Palo Alto, Cal., manufacturer of ultra-high-volt-



J. Mills

H. Deck

age insulating components, as design engineer for specialty transformers.

Jack Mills has been transferred from the Eastern sales office of The Zippertubing Co. to the Los Angeles headquarters as assistant to the sales manager.

Babcock Electronics Corp. has appointed *Woodrow Smith* as engineering manager.

William E. Wilson has been named vice-president and general manager while *Karl F. Crease* has been appointed vice-president in charge of manufacturing at the Chicago Standard Transformer Div., Essex Wire Corp., Chicago, Ill.

In the Central Research & Development Laboratories of Continental-Diamond Fibre Corp., Newark, Del., insulation producer, *Richard B. Goodrich* has joined the fibre research section as a research engineer and *Karel J. J. Brouwers* has been named a research specialist in the polymer research section.

At the newly-formed Fiber Development Department of Hercules Powder Co., Wilmington, Del., *Dr. Gilman S. Hooper* has been named director of research and development and *Desmond L. Farrell* has been appointed manager of the polypropylene fiber plant at Covington, Va. At the Cellulose Products Department, *Dr. Vernon R. Grassie* has been named director of development.

Lester F. Beers has joined Tri-Point Plastics Inc., Albertson, L.I., N.Y., as a project engineer.

F. L. Meeske, who for 41 years has been prominent in the development of the magnet wire industry, has retired as vice president of Anaconda Wire and Cable Co., Muskegon, Mich. He will continue as a director.

F. L. Meeske

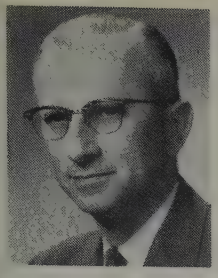
F. H. Gerlach

Francis H. Gerlach has joined the Porter-Cable Machine Co., Syracuse, N.Y., as vice president of engineering.

Frank H. Bower, formerly engineering administrator, has been named to the newly-created post of manager of research and development contracts for the Semiconductor Division of Sylvania Electric Products Inc., Woburn, Mass.

Barton B. Wadsworth, vice president of The Borden Chemical Co., New York City, since 1951, has retired. *Robert N. Stickney*, previously manager of Borden's Demopolis, Ala., plant, has been appointed works manager of the Illiopolis, Ill., plant which produces industrial polymers, coatings, and adhesive materials. At the Leominster, Mass., polyvinyl chloride plant, *Herman A. Peed* has been named production superintendent.

At the Spaulding Fibre Co., Tonawanda, N.Y., *Kent H. Alverson* has replaced retiring *Earl A. Russell* as chief engineer. *Martin A. Leuchtenberger*, Spaulding's paper mill manager since 1959, has been named assistant plant manager at Tonawanda. *John F. Nolan* is the new paper mill manager, and *Thomas R. Hall* is his



K. H. Alverson

J. F. Nolan

P. Schumacher

H. G. Andres

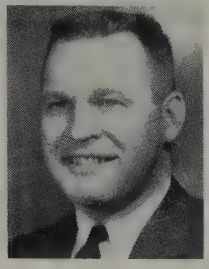
G. W. Voss

C. W. Kuhn

technical assistant. New assistant director of sales administration is *Paul B. Schumacher*, who has been with the firm since 1951. *Howard G. Andres*, former New York state sales engineer, has been named to manage a new sales office in Pittsburgh, Pa. *George W. Voss*, previously sales engineer at the Cleveland branch, has been appointed manager of the New York sales branch to succeed *Charles W. Kuhn*, who is now managing the firm's California sales operations.

The new post of chief engineer for Temptron Inc., Reseda, Calif., has been filled by *Everett Babbe*, who formerly was instrumentation engineer at The Marquardt Corp.

E. Babbe



J. T. Simmons

New vice president—operations for Hudson Wire Co. is *James T. Simmons*, previously general manager of Hudson's Ossining Div.

Plymouth Rubber Co., Inc., Canton, Mass., electrical tape manufacturer, has appointed two new sales representatives: *J. D. Burns* will cover Kansas and western Missouri for the Tape Div., and *Arthur Pickens* will cover Kentucky.

Gordon Thompson, formerly chief engineer, has been appointed vice president and technical director of Electrical Testing Laboratories Inc., New York City. *E. H. Salter*, previously manager of the Photometric Laboratory, succeeds Thompson, and *A. R. Chick*, with ETL since 1928, succeeds Salter. *Roger J. Amorosi* has joined ETL as assistant to the chief engineer.

The Connecticut Hard Rubber Co., New Haven, Conn., fabricator of silicone rubber, coated fabrics, and high temperature tapes, has appointed *J. A. Moffitt Jr.* marketing manager, and named *A. J. DeFrancesco* sales manager. Both formerly were product line sales managers.

Association News

Program for 1961 Temperature Symposium

The technical program is now complete for what is said to be the most comprehensive meeting ever held on the subject of temperature measurement. About 200 papers will cover temperature measurements from absolute zero to 10,000,000°K. Almost every area of the physical, biological, and medical sciences will be represented at the 1961 Symposium on "Temperature, Its Measurement and Control in Science and Industry," to be held in Columbus, Ohio, March 27-31, 1961. The conference is sponsored by the American Institute of Physics, the Instrument Society of America, and the National Bureau of Standards. Further information may be obtained by writing to V. W. Sikora, Instrument Society of America, 313 Sixth Ave., Pittsburgh 22, Pa.

Wescon Revises Rules for Show in San Francisco

Exhibitors at the 1961 Western Electronic Show and Convention in San Francisco next August 22-25 must comply with a new set of rules. WESCON has moved to distribute its limited floor space at the Cow Palace for better equity among large and small manufacturers while imposing conditions ensuring a broader sampling of products important to the industry and, by a new grouping arrangement, improving the locating convenience of show attendees. The rules changes include:

1) A new distributor-marketed components exhibit area, for the special convenience of distributors wishing to concentrate on line products.

2) A special-interest area for production and processing materials, hardware, services, and raw materials.

3) New eligibility rulings to avoid duplication.

4) The maximum number of booth spaces an exhibitor may apply for with assurance cannot exceed that held by the company in the 1960 WESCON.

5) No company, or division of a company, may separately hold more than two booth spaces.

New Materials Procurement Committee Approved by EIA

Establishment of the Materials Procurement Committee, a new group charged with handling problems of materials management affecting the electronics industry, has been approved by the Military Products Division of the Electronic Industries Association.

The committee, headed by H. A. Strickler of The Martin Co., is composed of directors of procurement and materials from EIA member-companies. The charter approved by the EIA Military Products Division, its parent organization, calls for the committee to exchange ideas and information on materials management, study the economics of purchasing, and consider government regulations and policies affecting materials management.

Symposium on Materials and Electron Device Processing

The American Society for Testing Materials will hold a three-day symposium on Materials and Electron Device Processing, April 5-7, 1961, at the Benjamin Franklin Hotel, Philadelphia.

The symposium, sponsored by ASTM Committee F-1 on Materials for Electron Tubes and Semiconductor Devices, will deal principally with the chemistry and physics of device processing. It is expected that this symposium will deal extensively with a variety of materials and processing problems common to electron tubes and other solid state devices.

2000 SWIRECO Registrants

A unique pre-registration campaign for the 13th Annual Southwestern Institute of Radio Engineers Conference & Electronics Show, April 19-21, has already resulted in more than 2,000 paid registrations of engineers and other scientific personnel.

The pre-registration drive, just begun, consists of personal calls on company executives.

The conference and show will be held in Dallas Memorial Auditorium and the Baker Hotel.

Name 1961 Wescon Executives

Chairman of the board for the 1961 Western Electronic Show and convention is Albert J. Morris, Stanford, Palo Alto; chairman of the executive committee is O. H. Brown, Eitel-McCullough Inc., San Carlos; convention director is Dr. John V. N. Granger, Granger Associates, Palo Alto; and show director is Calvin K. Townsend, Jennings Radio Manufacturing Corp., San Jose.

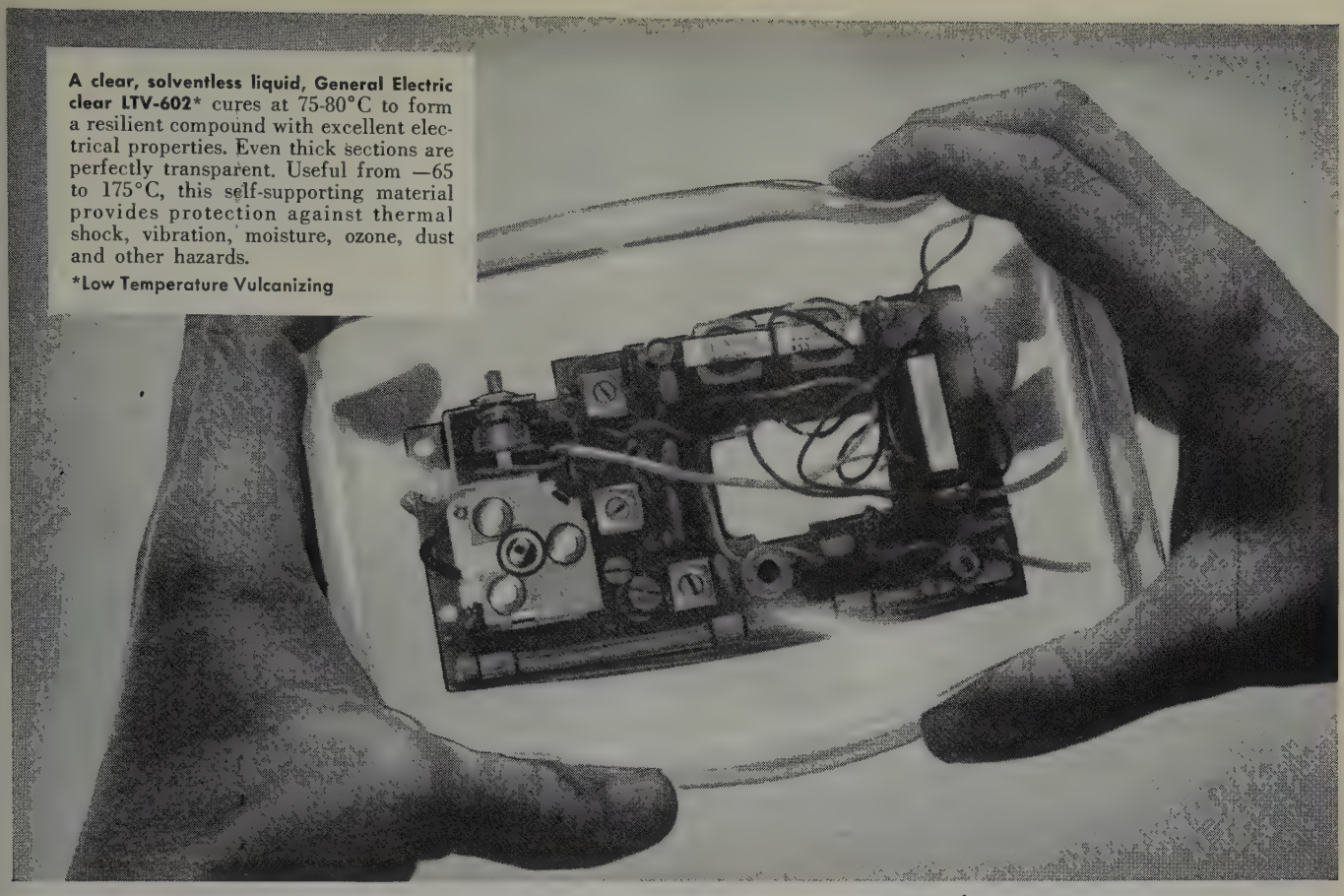
Board members from Southern California who will participate in general policy direction of WESCON-1961 are Bruce S. Angwin, General Electric Co., Los Angeles; Donald C. Duncan, Duncan Electronics Inc., Santa Ana; S. H. Bellue, Osborne Electronic Corp., Hawthorne; and Edward C. Bertolet, Behlman Engineering Co., Burbank.

New ASTM Group on Polymeric Films Meets March 8

A new group (Section G) has been set up in Subcommittee VII of the American Society for Testing Materials Committee D-9 in order to develop tests and specifications applicable to electrical instulation in the form of polymeric films that are not reinforced or coated with adhesives. The section will have its first meeting in the Sheraton Hotel at Louisville, Ky., on March 8. Those with an interest in this field are invited to attend this meeting or to contact the section in regard to particular concerns they may have. Chairman of the new section is J. P. Harrington, Film Dept., E. I. du Pont de Nemours & Co. Inc., Wilmington 98, Del.

Institute of Printed Circuits Meets March 21-22 in New York

Members of the Institute of Printed Circuits will meet in New York for their annual meeting on March 21-22

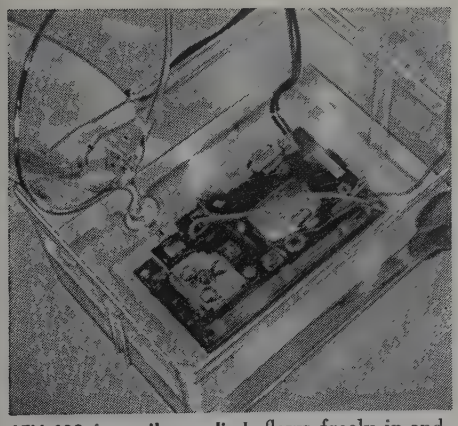


A clear, solventless liquid, General Electric clear LTV-602* cures at 75-80°C to form a resilient compound with excellent electrical properties. Even thick sections are perfectly transparent. Useful from —65 to 175°C, this self-supporting material provides protection against thermal shock, vibration, moisture, ozone, dust and other hazards.

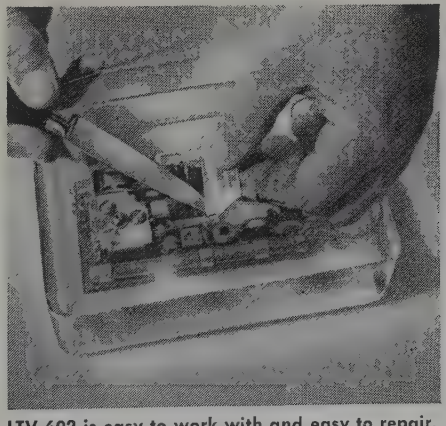
*Low Temperature Vulcanizing

General Electric clear LTV silicone compound for potting and embedding

Transparent, resilient, self-supporting and easy to repair



LTV-602 is easily applied, flows freely in-and-around complicated parts. Having a low viscosity in the uncured state, 800-1500 centipoise, LTV is ideal for potting and embedding of electronic assemblies. Unlike "gel-like" potting materials, LTV-602 cures to a flexible solid. Oven cure is overnight, or from 6 to 8 hours at 75 to 80°C.



LTV-602 is easy to work with and easy to repair. To repair parts embedded in LTV, merely cut out and remove section of material, repair or replace defective part, pour fresh LTV into opening and cure. Pot life, with catalyst added, is approximately 8 hours and may be extended with refrigeration. When desirable, LTV may also be cured at room temperature.

Resiliency offers excellent shock resistance. LTV-602 easily meets thermal shock tests described in MIL-STD-202A test condition B which specifies five temperature cycles from —65 to 125°C. Tests indicate that LTV retains protective properties even after 1800 hours aging at 175°C. Other tests confirm LTV's resistance to moisture and water immersion.

LTV-602 is the newest addition to the broad line of G-E silicone potting and encapsulating materials which also include the RTV silicone rubbers. For more information, write to General Electric Company, Silicone Products Department, Section M340, Waterford, New York.

GENERAL ELECTRIC

Print Ins. 34 on Reader Service Card

at the Barbizon Plaza Hotel.

Featured will be a report from E. E. Wright, Bell Laboratories, chairman of IPC's Thru Connection Committee, on the research and testing program on plated through holes and eyelets. An entire morning will be devoted to a discussion of the results of this program.

The IPC also plans a special session on "What's New in Raw Materials," in which associate (supplier) members will briefly present a report on what's new in their particular product line. A 10-minute presentation will be made by the official representative of each associate member company.

Committee sessions will be held on Tuesday, March 21.

The annual meeting and business session will be held on Wednesday afternoon, March 22, and will include a "How's Business Report" from IPC President, R. L. Swiggett.

The annual meeting of the IPC is open only to members. Additional information can be obtained from the IPC office, 27 East Monroe, Chicago 3.

SPE Sponsors Injection Molding Workshop April 4 and 5

The Pioneer Valley Section of the Society of Plastics Engineers will sponsor a two-day workshop or "refresher course" in injection molding on April 4 and 5, at Holy Cross College in Worcester, Mass. Technical program of this Regional Technical Conference will present fundamentals of both theory and practice of injection molding. Developed with the cooperation of SPE's Injection Molding Professional Activity Group, the program comprises informal classroom lectures by leading experts followed by panel discussions geared to audience participation.

Requests for program and registration information should be directed to Roger Johnston, RETEC Chairman, c/o Foster Grant Inc., 389 North Main St., Leominster, Mass.

Mica Association Elects Officers

At the annual meeting in New York, the Mica Industry Association Inc. elected the following officers: Robert J. St. Peter, Western Hemisphere Raw Materials Corp., president; Peter J. Yannello, Reliance Mica Co. Inc., 1st vice president; and Frank R. Koehler, the Otto Gerdau Co., 2nd vice president.

In recognition of his service to the industry and to the association, Frank F. Watts, Gillespie-Rogers-Pyatt Co. Inc., retiring president, was unanimously named an honorary life member.

The association voted to continue its technical information service for industry and welcomes technical questions on mica.

Exhibits at April IRE Show

One hundred and seven booth spaces have been scheduled for the 1961 Technical Conference of the Seventh Region of the Institute of Radio Engineers, April 26-28, at the Hotel Westward Ho, Phoenix. An attendance in excess of 2000 is expected from the 11 western states.

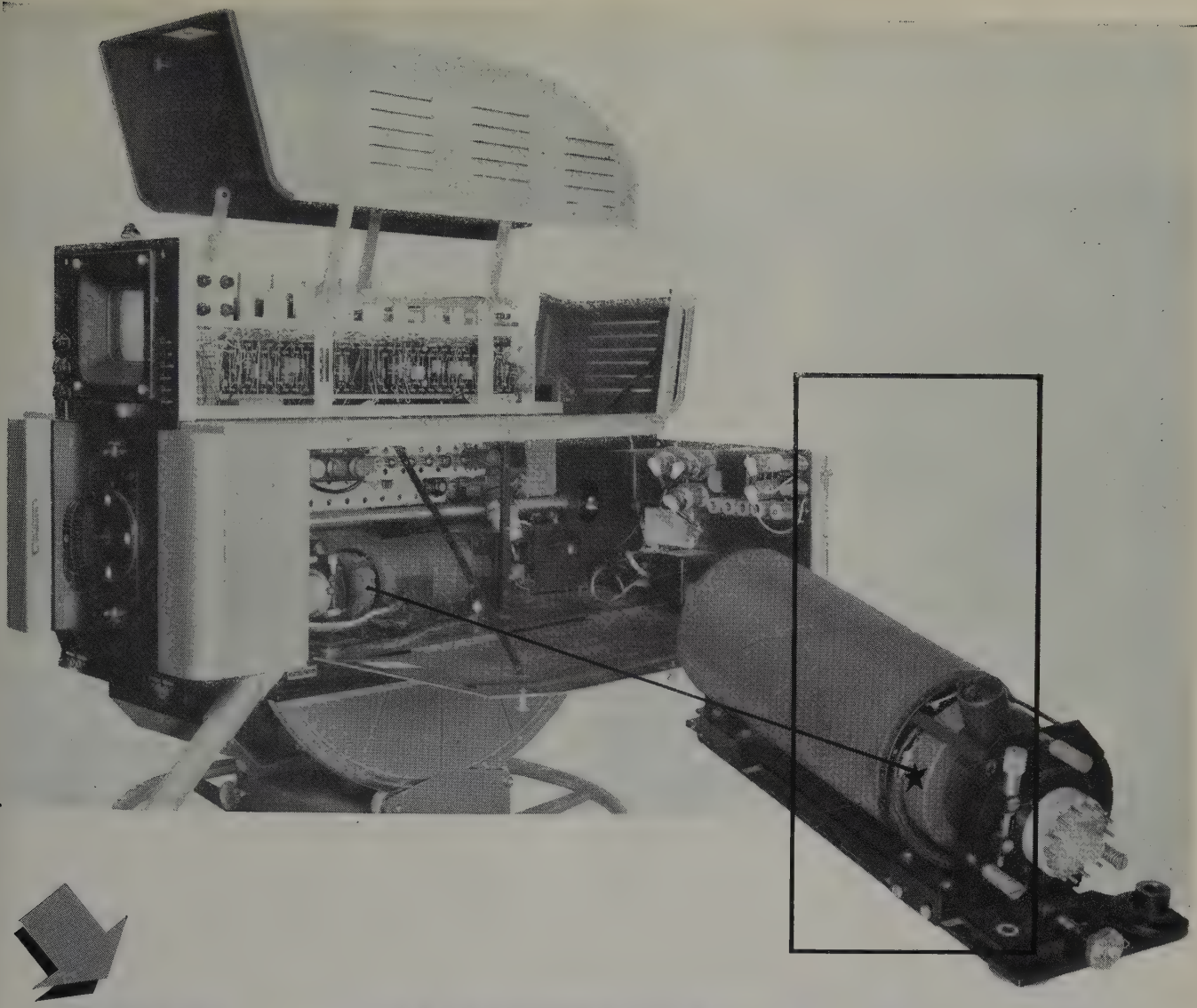
Environmental Engineers Convention Plans

A technical program featuring 70 presentations in the many orientations of the field of environmental testing has been announced for the annual meeting of the Institute of Environmental Sciences at the Sheraton-Park Hotel in Washington, D.C., on April 5, 6, and 7, 1961. Over 1000 scientists and engineers are expected to register for the sessions to exchange information on the latest advances in simulating environmental conditions encountered by satellites, missiles, rockets and all their components of ground support, control, and tracking equipment. A large exhibit floor will be devoted to the latest product developments by the environmental equipment and instrumentation manufacturers.

A girl and a young man were sitting on her couch discussing intellectual things such as telepathy.

"Would you call it telepathy," the girl asked, "if I were thinking about the same thing you are?"

"No," he replied, "I'd call it just plain luck!" *The Kablegram*



EPOXY gives FAST, PRECISE ENCAPSULATION for the Delicate Coil of a Color TV Camera

The alignment coils of television color cameras need the protection of encapsulation. And it needs high-quality insulation too. With compounds based on BAKELITE Brand epoxy resins, this RCA camera gets both, along with the efficiency and economy that offset the costs of limited-run production.

The insulating compound, made of BAKELITE Brand epoxy resins by Smooth-On Manufacturing Co., Jersey City, N. J., is deaerated before mixing with its hardener. The mold containing the coil is preheated to 50°C. Curing is accomplished in 16 hours at room temperature. The molds themselves are also made of tooling compounds based on BAKELITE Brand epoxy resins, and the encapsulating work is done by Torwico Electronics, Inc., Union, N. J.

These encapsulating compounds meet all the requirements for giving superior protection to delicate components. They penetrate every crevice without causing harm, for they can be cast with negligible shrinkage during cure, and their dimensional stability is excellent. Along with notable insulating properties, compounds based on BAKELITE epoxy resins have high impact strength, resistance to heat, moisture and chemicals, and the ability to be formulated to meet specific operating needs.

If you have any insulation problems, you should keep in touch with the increasing variety of uses for epoxies. For some general facts, or answers to particular questions, write Dept. KO-75C, Union Carbide Plastics Company, Division of Union Carbide Corporation, 270 Park Avenue, New York 17, N.Y. *In Canada:* Union Carbide Canada Limited, Toronto 12.

"BAKELITE" EPOXY RESIN INSULATION GIVES YOU SUPERIOR—

- Heat resistance
- Moisture resistance
- Chemical resistance
- Impact resistance
- Flame resistance

BAKELITE and UNION CARBIDE are registered trade marks of Union Carbide Corporation.

UNION CARBIDE

Print Ins. 36 on Reader Service Card

New Publications

Books

Printed Circuit Design Parameters for Data Processing and Communications Equipment. Proceedings of a recent seminar includes a comprehensive report from each of four panel members describing the design parameters used by their company. Each paper contains information on dimensions, connections, finishes, component mountings, and quality control. Also included is a discussion of "Production of Fine Lines by Etching Techniques." $5. Institute of Printed Circuits, 27 E. Monroe, Chicago 3.

Ultrasonics and Its Industrial Applications, by O. I. Babikov. Although translated from Russian and covering recent Soviet advances, this volume is universal in scope. Among areas covered fully are ultrasonic control methods, the action of high-intensity ultrasonic oscillations on various technological processes, ultrasonic drilling techniques, and ultrasonic pulse methods of flaw detection and physicochemical research. 230 pages, $9.75. Consultants Bureau Enterprises Inc., 227 W. 17th St., New York 11.

Spectra and Analysis, by A. A. Kharkevich. Translated from Russian, it deals with spectral concepts as they apply to oscillations in acoustics and electronic engineering and with methods of spectral analysis. The first two sections cover a large amount of material briefly, providing a concise and comprehensive survey. The third section, dealing with the spectra of random processes, documents Soviet research that is completely original. 232 pages, $8.75. Consultants Bureau Enterprises Inc., 227 W. 17th St., New York 11.

STP 56-N, 1959 Supplement to the Bibliography and Abstracts on Electrical Contacts. Paper cover, 64 pages, 6″ x 9″, $3.50. American Society for Testing Materials, 1916 Race St., Philadelphia 3.

Electronic Tubes and Semiconductor Elements, edited by P. Mikolajczyk. Contains data in seven languages—English, French, Spanish, German, Polish, Russian, and Italian —relating to all tubes manufactured throughout the world that are used in radio receivers and transmitters (up to 500 W of dissipated power), television and telecommunication equipment, computers, etc. It includes about 5000 characteristic curves and operation schemes for approximately 20,000 tubes and semiconductors, as well as their dimensioned outlines. 11″ x 8″, $20. Pergamon Press Inc., 122 East 55th St., New York 22.

Two new publications have been made available as a part of the Electronic Industries Association's vocational education program. They are:

Satisfying Customers for Profit, a guide to solution of servicemen's customer relations problems. It relates 25 case histories of good customer relations practices in the handling of situations occurring most frequently in electronics servicing. Howard W. Sams and Co., Indianapolis 6, Ind.

Industrial Electronics, Laboratory Manual for Electronic Technicians, by Paul B. Zbar, New York Trade School. Presents 39 experiments on basic circuits and their application. McGraw-Hill Book Co., 330 West 42nd St., New York 36.

The following four additions to the plastics applications literature may be ordered from the Reinhold Publishing Corp., 430 Park Ave., New York 22.

Polypropylene, by Theodore O. J. Kresser. Brings together all phases of polypropylene properties, production, and applications in a way that can be understood by readers without special training in polymer chemistry. 304 pages, $6.50.

Metallizing of Plastics, by Harold Narcus. Presents complete details for carrying out every commercial metallizing process for plastics or other non-conductors. 208 pages, $5.50.

Polystyrene, by William C. Teach. Provides a simplified, yet technically accurate, introduction to the chemistry, properties, manufacture, and uses of polystyrene. 224 pages, $5.

Runnerless Molding, by Ernest P. Moslo. Describes in detail the methods of injection molding accomplished without the removal of a sprue and runner system on each molding shot. 179 pages, $4.95.

Standards

RS-154-B, Polarized Dry Aluminum Electrolytic Capacitors for General Use (from revision RS-154-A and Standards Proposals Nos. 620 and 636). 12 pages, $1.20. Electronic Industries Assn., 11 W. 42nd St., New York 36.

MW 62-1960, Wooden Pallets for Returnable Reels Used for Magnet Wire. Covers material, dimensions, and bonding of wooden pallets for use in shipping the following types of returnable reels for magnet wire: 1) 16″ wood metal reels in groups of 8 and 12, 2) 24″ wood metal reels in groups of 8. 20 cents. National Electrical Manufacturers Assn., 155 E. 44th St., New York 17.

Three new industry standards for the testing of pre-preg laminating materials provide users as well as manufacturers with a uniform basis for judging a pre-preg's production characteristics and performance. They are:

SPI Prepreg—1, Resin and Volatile Content of Preimpregnated Inorganic Reinforcements.

SPI Prepreg—2, Flow of Preimpregnated Products.

SPI Prepreg—3, Measurement of Gel Time of Preimpregnated Inorganic Reinforcements.

They may be obtained from the Society of the Plastics Industry Inc., 250 Park Ave., New York 17.

Preferred Circuits Handbook, Supplement No. 3. Covers 7 germanium transistor circuits, 2 silicon transistor circuits, and 1 vacuum-tube instrument servo circuit. 100 pages, 55 cents. Order NAVWEPS 16-1-519 from the Supt. of Documents, U. S. Government Printing Office, Washington 25, D.C.

Zero burnout time
and minimum "haloing"
are combined in CDF's new grade 614 glass fabric epoxy laminate at no increase in price over conventional NEMA G-10 grades. Available plain or copper-clad, 614 is a cold punch material that is also superior in flame retardancy, has excellent trichloroethylene vapor resistance and low moisture absorption. The grade is distinguished by its opacity and its tan color.

Result: Another example of CDF leadership in meeting critical military and industrial applications while effecting important customer savings!

Typical properties of 614 (1/16" thickness):

Burnout Time, sec.	0
Water Absorption	0.10
Flexural strength, psi, lw	75,000

(Copper-clad 614 meets MIL-P-13949B, Type GF Plain meets NEMA G-10, approval pending for MIL-P-18177B, Type GEE. Also pending under NEMA proposed FR-4)

CDF CONTINENTAL-DIAMOND FIBRE

CONTINENTAL-DIAMOND FIBRE CORPORATION, NEWARK, DELAWARE • A SUBSIDIARY OF THE Bird COMPANY

New Literature

All catalogs, bulletins, and other literature or sample cards described are available free of charge. To obtain your free copies, just print the item number on the Reader Service Card on the back cover. Fill out and mail the card—no postage is required. Insulation *immediately forwards your requests to the companies concerned so that the literature can be sent to you promptly.*

Polyethylene Resin Guide

New brochure on complete line of "Elrex" brand injection and blow molding polyethylene resins contains tabular data on significant properties. All three ASTM density types are represented. Suggested applications are included. In addition, an explanation of the Elrex nomenclature system is presented. Literature Service, Rexall Chemical Co., P.O. Box 37, Paramus, N.J.

Print No. Ins. 201 on Reader Service Card

Silicone Rubber Selector Chart

A new and revised silicone rubber selector chart, CDS-145C, is said to be one of the most complete silicone rubber specification guides available. The publication is designed to assist designers and engineers in all industries in selecting the proper type of silicone rubber for their particular requirements. It contains comprehensive data on applications, typical properties, primary classes, and standard industry and military specifications. To make selection of the proper silicone elastomer easy, compounds are divided into four general classes and typical uses of each class are described. 4 pages. Silicone Products Dept., General Electric Co., Waterford, N.Y.

Print No. Ins. 202 on Reader Service Card

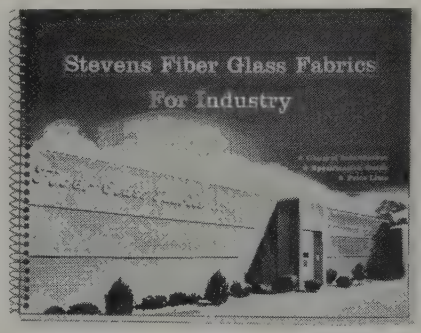
Data Sheet on Black Baking Varnish for Class F Use

Data sheet describes a new "Hi-Therm" BB-345 black baking varnish designed for class F uses such as treatment of transformers, stators, and random and form wound coils. Appearance, specifications, electrical properties, chemical resistance, curing time test results, and application data are given. 2 pages. John C. Dolph Co., Monmouth Junction, N.J.

Print No. Ins. 203 on Reader Service Card

Fiber Glass Fabric, Tape and Roving Data and Price Brochure

A new comprehensive, illustrated fact and price brochure lists the most widely used constructions of fiber glass fabrics, woven rovings, and tapes for the electrical, reinforced plastic, and coating industries. It contains detailed specifications of the



various glass fabrics, their prices, photographs of the production processes, and detailed sketches of weave patterns. Also, specific constructions are recommended for the various industries, and special listings of all fabrics both by weight and by thickness are included. The applicable military specifications are given, as well as detailed explanations of the many specialized finishes used for glass fabrics. 32 pages. J. P. Stevens & Co. Inc., Industrial Glass Fabrics Dept., Broadway and 41st St., New York 36.

Print No. Ins. 204 on Reader Service Card

Motor Slot Wedge Bulletins

Several new bulletins are devoted to motor slot wedges of all types. Bulletin 38 gives outstanding features, illustrates forms, and lists electrical and physical properties of new epoxy-glass space-saving U-shaped wedges. 4 pages. Bulletin 37 discusses advantages of a new Tube-Pak shipping and storage container for protecting formed fibre. 1 page. Bulletin 40 contains a chart which compares the properties of numerous wedge materials. It also illustrates wedges of different materials and gives some of their outstanding features. 2 pages. Insulation Manufacturers Corp., 565 W. Washington Blvd., Chicago 6.

Print No. Ins. 205 on Reader Service Card

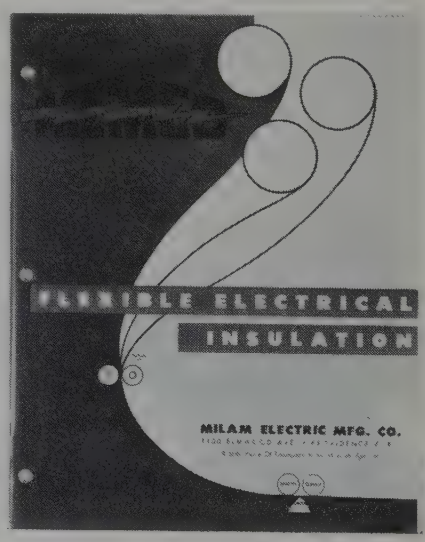
Bulletin on Epoxy Resins For Clear Castings

Ways to make high-impact or flexible as well as rigid castings from 'Maraglas' #655 transparent epoxy resin are outlined in a revised technical bulletin. The bulletin summarizes characteristics and lists electrical and mechanical properties. Among the uses specified are production of electrical and electronic encapsulations, embedments, models, prototypes, and tubes, and use as a clear laminating resin or adhesive. Sections cover resin and hardener mixtures and curing methods for rigid, high-impact, and flexible castings. Prices are given. 2 pages. Marblette Corp., 37-31 Thirtieth St., Long Island City 1, N.Y.

Print No. Ins. 206 on Reader Service Card

Catalog of Flexible Composite Insulations

A comprehensive catalog contains information, data, and suggestions on a wide variety of flexible composite electrical insulations. It describes the function of electrical insulation in detail and explains the application,



This 24" diameter coil wound with 18 pounds of #.064x.130CCHEP rectangular magnet wire, is entirely self-supporting because it's made of Anaconda's new cement-coated epoxy magnet wire. The outstanding bond strength of this wire is stable at high temperatures, too, so coils can be removed from the oven and handled while still hot without danger of deforming.

new CEMENT COATED EPOXY magnet wire makes possible coils that hold their shape without support, hot (200 C) or cold

The secret's in the bond strength. Anaconda's new 130 C (Class B) cement-coated epoxy magnet wire forms a bond so strong that the coil is completely self-supporting.

No ties or braces are needed at any temperature up to 200 C. In fact, it can be removed from the oven at 200 C and dipped in encapsulating materials without losing its shape. Both ways you save on production costs.

The unique Anaconda epoxy cement coating softens just enough to bond each wire firmly to adjacent wires. The higher the temperature (to 200 C) the stronger the bond. It's a contact bond with minimum flow.

And the inherent dielectric properties and limited flow of the epoxy cement actually contribute to the electric strength of windings. Thus you can use cement-coated epoxy wire with little or no increase in overall diameter of the wire.

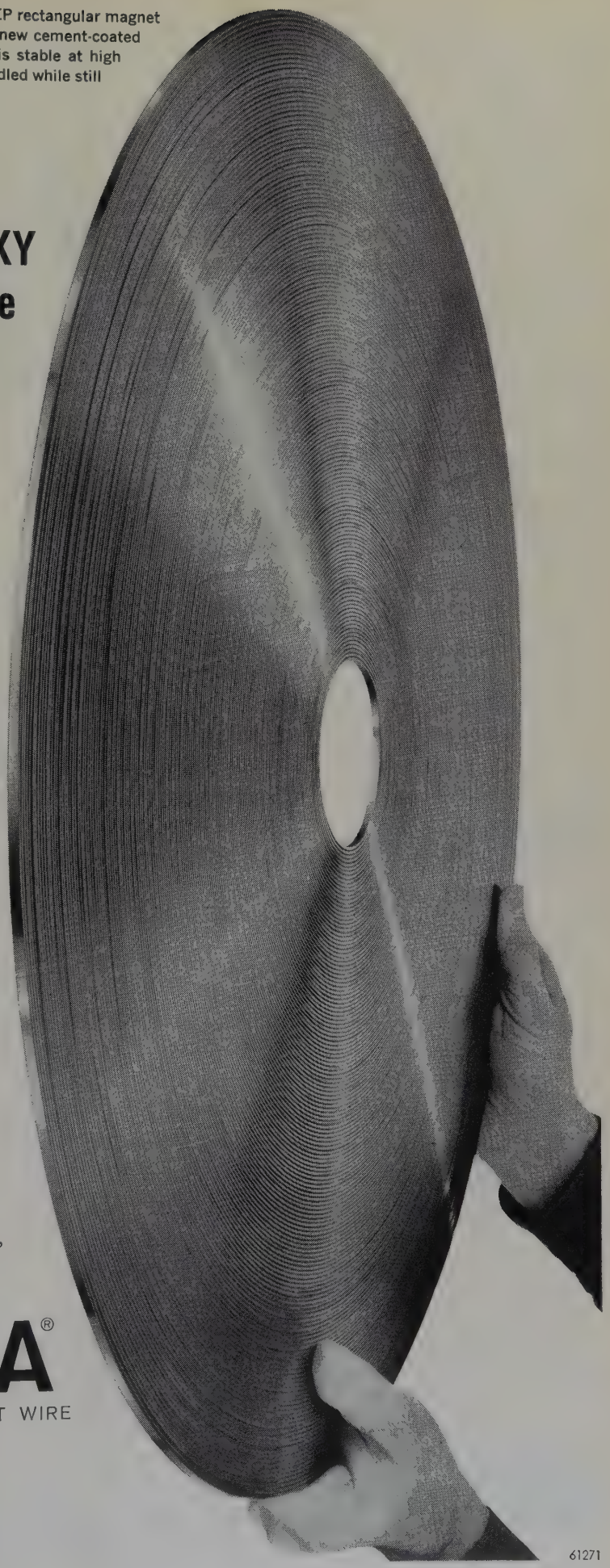
More advantages: Anaconda cement-coated epoxy magnet wire won't hydrolize in enclosed systems; it's completely compatible with standard transformer oils, varnishes, insulation and encapsulating materials; it's available in all sizes of round, square and rectangular, in spools, reels, pails or drums.

For more information about Anaconda cement-coated epoxy magnet wire, contact Anaconda Wire and Cable Company, 25 Broadway, New York 4, New York, Department EFL-1-I.

ASK THE MAN FROM

ANACONDA®

FOR CEMENT-COATED EPOXY MAGNET WIRE



61271

Print Ins. 37 on Reader Service Card

properties, and types available in a line of combinations and constructions, including asbestos-glass cloth, asbestos-"Mylar", "Dacron" mat-Mylar, glass cloth-Mylar, paper-Mylar, and miscellaneous composites. 28 pages. Milam Electric Mfg. Co., 1100 Elmwood Ave., Providence 7, R.I.

Print No. Ins. 207 on Reader Service Card

Insulation Materials and Manufacturing Facilities Booklet

Pocket-size booklet titled "Dynamic Ideas in Materials," describes insulating materials, products made from them, and their application in such fields as electronics, electrical equipment, automobiles, missiles, aircraft, data processing, etc. 12 pages. Rogers Corp., Rogers, Conn.

Print No. Ins. 208 on Reader Service Card

Bulletin on High Heat Ceramics

Bulletin 121 describes the new HT-1 series of high heat and wear resistant high alumina ceramics. Applications are listed as well as complete data on the 3 basic types available. The data includes information such as specific gravity, softening temperature, hardness, thermal expansion coefficient, tensile strength, compressive strength, dielectric constant, power factor, and thermal conductivity. The bulletin also lists sizes and tolerances available along with fastening methods. 1 page. Duramic Products Inc., 426 Commercial Ave., Palisades Park, N.J.

Print No. Ins. 209 on Reader Service Card

Cable Termination Reprints

New booklet consists of four reprints of AIEE papers. Papers discuss various applications for cable accessory kits using special epoxy resin formulation and "Orlon" tape. Among the applications discussed are the use of the epoxy-Orlon system for making hermetic seals on 33 kv paper-lead cables, for making potheadless terminations in the 4 to 15 kv range, for making lead-sheath-crack repairs, for insulating 500 MCM limiters, for making rubber-to-lead splices, for low-voltage cast potheads and splices, for 5 kv oil-stops, etc. Complete data are given. The Epoxylite Corp., 1428 N. Tyler, South El Monte, Calif.

Print No. Ins. 210 on Reader Service Card

Bulletin on Nylon and Molybdenum Disulphide Molding Compound

A new product bulletin covers "Nylatron" GS, a molding compound of nylon and molybdenum disulphide. The bulletin features a roundup of 45 new application case histories as well as average electrical and physical property data. Product advantages for both industrial designers and injection molders are included. 4 pages. Molding Resins Division of The Polymer Corp., Reading, Pa.

Print No. Ins. 211 on Reader Service Card

Bulletin on Motor and Transformer Insulation, Wedges, Etc.

New bulletin No. 30 illustrates production facilities and contains data sheets on cuffed coils for slot insulation, crimped paper coils for transformer layer insulation, formed fibre wedges, plastic film/paper combinations, slot insulation creaser/cutter, and insulation storage systems. 14 pages. Lenni Products Inc., P. O. Lenni Mills, Lenni, Pa.

Print No. Ins. 212 on Reader Service Card

Ceramics Bulletin

Bulletin 1060 contains information on semi-conductor packages, tunnel diode enclosures, and insulated stud type diode mounts. Included also are physical, thermal, mechanical, and electrical properties of two ceramic bodies. Frenchtown Porcelain Co., Frenchtown, N. J.

Print No. Ins. 213 on Reader Service Card

Reinforced 'Teflon' Bonding Bulletin

New technical bulletin, TSP#121 (revised), reports on the adhesives and methods for bonding reinforced Teflon to itself and to metals. Surface etching and bonding without etching are covered. Ten adhesives for bonding reinforced Teflon to itself and 7 for bonding it to various metals are listed. Suppliers of the various products are identified. 3 pages. Rogers Corp., Rogers, Conn.

Print No. Ins. 214 on Reader Service Card

Booklet on Insulated Electronic Hook-Up Wire and Shrinkable Tubing

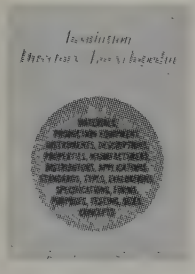
A new brochure contains condensed data on a complete line of electronic hook-up wire and shrinkable tubing. It supplies specifications for wire products with temperature ratings from —65°C to +260°C and voltage ratings from 600 v to 3000 v rms. Insulating materials include polyvinyl chloride, polyethylene, "Teflon," and irradiated polyolefin (said to be especially suited for high temperature applications and available in both solid and foam types). Also featured are "Tri-Tin" flexible conductors and "Hyshrink" irradiated polyolefin tubing and sleeving which shrinks under heat to fit irregular shapes. Brochure DM-S-6014 also contains tables covering decimal equivalents, temperature conversions, and AWG data for standard annealed copper wire. 12 pages. Department EFL, Anaconda Wire & Cable Co., 25 Broadway, New York 4.

Print No. Ins. 215 on Reader Service Card

Coaxial Cable Connector Brochure

Illustrated brochure describes new connectors for aluminum sheathed, high frequency "Styroflex" and "Foamflex" coaxial cables. Full mechanical and electrical specifications along with typical installation instruc-

BY LAKE PUBLISHING CORPORATION
PUBLISHERS OF



NEW. . . filling a need not presently being met—here's how:

NEW . . . because editorially *Plastics Design & Processing* is concentrating solely on providing practical technical information on the processing and design/use of plastics.

NEW. . . because *Plastics Design & Processing's* qualified subscribers consist specifically and exclusively of the men concerned with the processing and volume manufacturing use of plastics . . . the men who *buy and specify* your products. Qualified subscribers *do not* include raw materials producers, plastics equipment manufacturers, marketing personnel, etc. And the methods of selecting—and pinpointing—the qualified, action-minded readers are methods which are almost unique in the publishing industry.

NEW . . . because its advertising pages offer suppliers of materials, equipment, tools, molds, and services a rare opportunity to effectively and economically reach prospective buyers. The editorial atmosphere in PDP is completely oriented to your buyers . . . not to your competitors. And the qualified circulation is entirely waste-free—composed 100% of the men who buy and specify . . . there's no loss of advertising investment because there's no danger of "talking to yourself."

FIRST ISSUE April 1961—with tremendous impact and advertising value, even more than for normal first issues, because pre-qualified and pre-verified readers will be looking forward eagerly to receiving *Plastics Design & Processing*. A must for your advertising schedule.

SECOND ISSUE June 1961—an unusual show issue and preview of the National Plastics Exposition and Conference. And there will be extra bonus circulation—free copies distributed to the men attending the exposition. Make it a key portion of your advertising program.

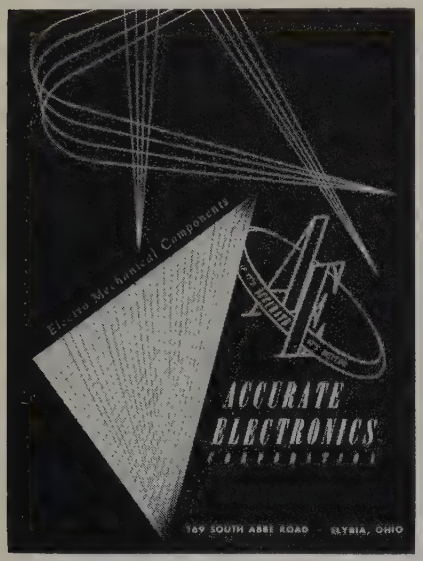
MONTHLY starting with the August 1961 issue. The April and June issues will establish *Plastics Design & Processing* as the pace-setter in the field . . . as the *only* magazine exclusively concerned with the men who buy and specify products such as yours. Plan now to make the April, June, August, and all succeeding monthly issues an essential, substantial part of your advertising program.

Plan now to make PLASTICS DESIGN & PROCESSING with its 100% effective circulation a valuable part of your marketing program. For rates and other information, contact Lake Publishing Corp., Box 270, Libertyville, Ill. Phone EMpire 2-8711.

tions are given. 8 pages. Phelps Dodge Copper Products Corp., 300 Park Ave., New York 22.
Print No. Ins. 216 on Reader Service Card

Electronic Components Catalog

New catalog contains all literature available to date on a line of electronic products, including jacks, plugs, terminals, and terminal boards and strips. Assemblies are pictured with



drawings showing dimensions. Specifications are noted with design features. Facilities are described. 38 pages. Accurate Electronics Corp., 169 S. Abbe Rd., Elyria, Ohio.
Print No. Ins. 217 on Reader Service Card

Booklet on Wire and Cable for Aircraft, Missiles, and Industry

New catalog No. 458 describes characteristics and lists specifications of a line of high temperature aircraft electrical cables and aircraft and industrial thermocouple wire made to military specifications and ISA standards. Insulations featured include "Teflon," asbestos, fiber glass, silicone, and silicone rubber used singly or in various combinations. 20 pages. The Lewis Engineering Co., Naugatuck, Conn.
Print No. Ins. 218 on Reader Service Card

Bulletin on Fine Wire For Electronics

New bulletin contains data on fine wire (bare or insulated) for semiconductors, resistors, potentiometers, thermocouples, electronic tubes and other electronic applications. It also contains a useful, authoritative chart on fine wire applications, compositions, and pertinent properties. 4 pages. Consolidated Reactive Metals Inc., 115 Hoyt Ave., Mamaroneck, N. Y.
Print No. Ins. 219 on Reader Service Card

Catalog of Instruments for Electrical Research and Production Testing

New illustrated catalog 10-1.3 describes an enlarged line of instruments for electrical research and production testing. Included are: dielectric test sets ranging from heavy-duty types with a-c or d-c potentials to 150 kv . . . through mobile, bench, and hand-carried portable models, instruments for testing insulating materials and insulating oils in compliance with applicable Mil and Federal Specifications, an arc resistance tester, megohmmeters with ranges to five-million megohms for laboratory and production measurement of insulation resistance, corona detection and measurement equipment, portable kilovoltmeters, sphere gap assemblies, and high voltage power supplies. A section of the new catalog is devoted to instrumentation for automated testing of electrical components, cables, switchgear, and circuits of complex assemblies. 12 pages. Associated Research Inc., 3777 W. Belmont Ave., Chicago 18.
Print No. Ins. 220 on Reader Service Card

Capacitor Engineering and Insulation Data Manual

Previously unpublished reliability test data accumulated on over 100,000 capacitors since 1930 is released for the first time in a new manual which provides information on such parameters as voltage, temperature, frequency, insulating materials, and area of windings. The new manual discloses how life, capacitance, and leakage current are affected over extended temperature ranges. Dissipation factor comparisons dating from the time of linen paper to today's "Teflon" film dielectrics are presented. Bulletin 60121. John E. Fast & Co., 3598 N. Elston Ave., Chicago 18, Ill.
Print No. Ins. 221 on Reader Service Card

Plastics Career Brochure

A new brochure, "Plastics as an Engineering Career," contains brief descriptions of plastics materials, the plastics industry, the role of the plastics engineer, and engineering organization in plastics. It outlines the scientific and engineering opportunities in the plastics industry, and covers the training of a plastics engineer. Background material and data on both polymers and the plastics industry are included. 8 pages. Society of Plastics Engineers, 65 Prospect St., Stamford, Conn.
Print No. Ins. 222 on Reader Service Card

Salt Spray Test Chamber Bulletin

Illustrated bulletin C-11-2 describes a new line of salt spray chambers for environmental testing constructed of corrosion-resistant acrylic plastic. Working dimensions, specifications, and price information on the four models are given. 2 pages. Associated Testing Laboratories, Wayne, N.J.
Print No. Ins. 223 on Reader Service Card

Testing Equipment Bulletin

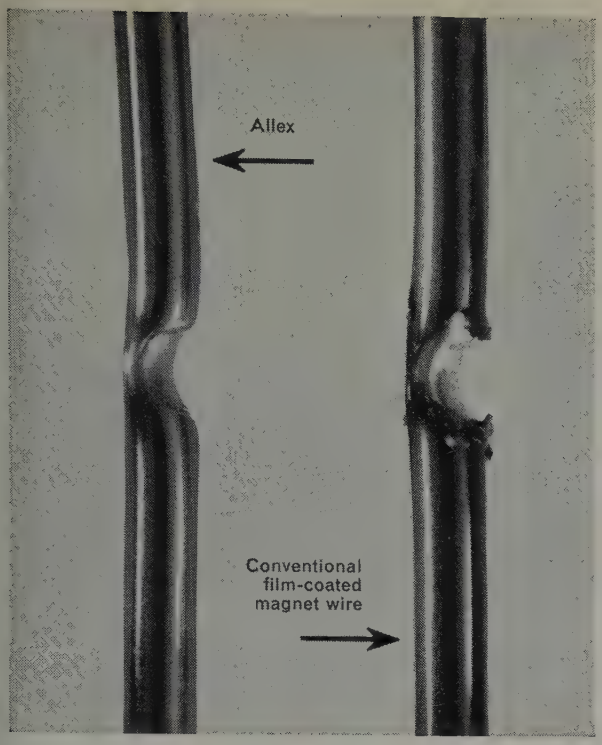
New Bulletin #5901, "Facts on Testing," contains data on a combined tensile and tear tester sample cutter, air operated grips for tensile tester, the adhesives tester, the four square cutter, the Spencer impact attachment for the Elmendorf tearing tester, toughness tester attachment for the Elmendorf tearing tester and Elmendorf calibration check weights. 4 pages. Thwing-Albert Instrument Co., Penn St. and Pulaski Ave., Philadelphia 44.
Print No. Ins. 224 on Reader Service Card

Bulletin on Rebuilding Distribution Transformers

Illustrated bulletin, GEA-7108, describes the process facilities, and advantages of rebuilding old distribution transformers. It contains a chart of average life span of transformers and a description of the "Permalex" transformer insulation system for distribution transformers. 8 pages. General Electric Co., Schenectady 5, N.Y.
Print No. Ins. 225 on Reader Service Card

"Now that will be a premium of $16.37 per month on a straight life," said the insurance salesman. "That's what you want, isn't it?"

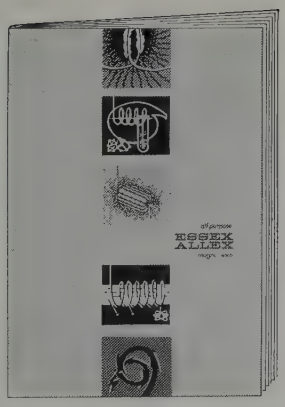
"Well," the customer replied, "I would like to play around a little on Saturday nights."—*"By Gum!" Reichhold Chemicals Inc.*



EXTRAORDINARY CUT-THRU RESISTANCE!

Unretouched photo of #18 gauge wires which had been subjected to the constant temperature (250°C.) increasing pressure cut-through test. A 60 pound weight which deformed the conductor did not rupture the film on Allex.

New technical report proves why all-purpose ESSEX ALLEX is a major advancement in magnet wire



Complete technical report now available. Write for your copy today.

Contains full information on application and on electrical, physical, chemical and thermal properties.

You can do more with Allex, the new all-purpose magnet wire with the greater safety factor. Film-coated and rated at 220°C, Allex is a magnet wire enameled with DuPont ML resin.* This major advancement should permit further product miniaturization, and provides an entry into new frontiers of elevated temperature design.

* *E. I. duPont De Nemours & Co. — Type ML Resin.*

MAGNET WIRE DIVISION

ESSEX WIRE CORPORATION
Fort Wayne, Indiana
National Network of Warehouses and Sales Offices . . . Call Your Local "Essex Man."

Print Ins. 40 on Reader Service Card

Industry News

Hercules Powder Co. has formed a Fiber Development Department and purchased *Industrial Rayon Corp.'s* fiber plant in Covington, Va. The former nylon section of the Covington plant will be converted to the spinning of polypropylene fibers, with an annual capacity in excess of 10-million pounds.

General Plastics Corp. has added "Rokide" ceramic spray coatings to its custom coating service. It will conduct its coating operations at its new Bloomfield, N. J., plant.

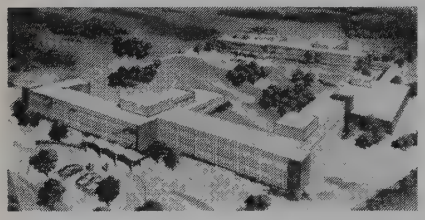
The *Electrada Corp.* has completed construction of a new Photo-Optronic Laboratory in Culver City, Cal., to study the nature of light in its application to electronics and chemistry.

Shawinigan Resins Corp., Springfield, Mass., has appointed *Van Waters and Rogers Co.*, Dallas, as sales agent in Texas for its polyvinyl resins and emulsions.

Schaevitz Engineering, Pennsauken, N. J., has purchased the assets of *Smith & Macgeorge*, Norristown, Pa., electronic instruments firm.

W. R. Grace & Co.'s plastics expansion program for its *Polymer Chemicals Div.* includes a 50 percent increase in production facilities at the Baton Rouge, La., high density polyethylene plant and additions to the division's range of polystyrene resins.

Sylvania Electronic Systems, a division of *Sylvania Electric Products Inc.*, has started construction of a new Applied Research Laboratory



and a new headquarters building on a 55-acre site adjacent to present facilities in Waltham, Mass. The two new two-story buildings will add about 107,000 sq ft to existing facilities. A 17,000 sq ft addition to its semiconductor plant at Hillsboro, N. H., with construction scheduled to begin in April, will bring the total plant area in Hillsboro to 53,000 sq ft.

Coast Manufacturing & Supply Co., Los Angeles, Cal., has appointed *Hastings Plastics Inc.*, Santa Monica, Cal., as a distributor for the complete line of Trevarno glass fabrics.

General Electric Co.'s Silicone Products Department has decreased the price of silicone antifoam compounds by 20 cents per pound and Antifoam 60 emulsion by 10 cents per pound.

E. A. Dickinson & Associates, Milwaukee, has been appointed sales representative for Wisconsin by *Cincinnati Development & Mfg. Co.*, manufacturer of glass polyester insulation products.

Carbro Chemical Co., Pawtucket, R. I., manufacturer of electrical wire coatings, has been acquired by *Sun Chemical Corp.* and will be integrated into that company's recently-formed Chemical Coatings Division.

Case Brothers Inc., Manchester, Conn., manufacturer of electrical in-

sulating papers and pressboards, is completing its new and additional plant at Brattleboro, Vt.

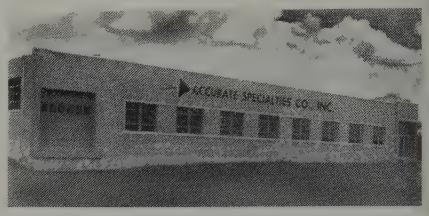
Statham Development Corp., a wholly owned subsidiary of *Statham Instruments Inc.*, Los Angeles, has been merged with the parent company.

The Polymer Corp., producer of industrial plastics, has opened a new building in Industrial Park, Rolling Meadows, Ill., to house the offices and warehouse of *The Polymer Corp. of Penna.*, a subsidiary.

An addition of 30,000 square feet to the Costa Mesa, Cal., facilities of *Babcock Electronics Corp.* has been announced.

Leepoxy Plastics Co. has been formed at New Haven, Ind., by Max M. Lee, formerly with General Electric Co. and Armstrong Products Co. The new firm will manufacture epoxy curing agents and formulate resin systems.

Accurate Specialities Co. Inc. has



opened a 15,000 square foot plant at Hackensack, N.J.

Union Texas Natural Gas Corp., Houston, Texas, has entered the field of applied physics and advanced electronics through a newly-formed company, *Quantatron Inc.* of Santa Monica, Cal.

Garlock Electronic Products operation of *Garlock Inc.*, Rochester, N.Y., producer of industrial plastics, has appointed the following distributors: Newark Electronics Co., Chicago and Inglewood, Cal.; Harrison Radio Corp., New York; Wesco Electronics, Pasadena, Cal.; Schad Electronics, San Jose, Cal.; Dalton-Hege Inc., Winston - Salem, N.C.; Inter - State Radio & Supply Corp., Denver; and Lake Engineering Co. Ltd., Scarborough, Ontario.

Five manufacturer's representatives have been selected by *American-Marietta Co.* to service sales of epoxy molding compounds: Testco, Seattle; Evra Inc., Los Angeles; Shefler-Kahn Co., Phoenix; M. F. Klicpera Co., Houston and Dallas; R. G. Bowen Co., Inc.

Robertshaw-Fulton Controls Co.'s Aeronautical and Instrument Division at Anaheim, Cal., has realigned its engineering groups to identify them by product-line designation. They include Instrument Products Engineering, Computer-Communications Engineering, Mechanical Products Engineering, and Oxygen Products Engineering.

Accurate Resistor Co., manufacturer of precision wire-wound resistors, has moved to new and larger facilities in Burbank, Cal.

Atlee Corp., Waltham, Mass., now consists of what previously were four separate companies (Atlee, Wesco Electrical Co. Inc., Applied Dynamics Corp., and Industrial Electronics Co. Inc.).

Ceramics International Corp., Mahwah, N.J., has been formed to manufacture ceramic-to-metal fabrications for the electronics industry.

Electricable Inc., North Hollywood, Cal., has appointed Edward F. Aymond Co., Dallas, to handle sales in Texas, Oklahoma, and Arkansas.

Commercial Plastics & Supply Corp. now occupies an entire square block at a new location in Newark, N.J. CP&S also has been appointed a distributor of "Rexolite" insulations manufactured by the *William Brand-Rex Div., American Enka Corp.*

The Siegler Corp., Los Angeles, has formed a Space Systems Technology Group in Inglewood, Cal.

Redel Inc., Anaheim, Cal., has reduced prices and expanded capacity for custom etching of "Teflon," "Kel-F," and other fluorocarbon plastics to facilitate their bonding or encapsulation.

Viking Wire Co. Inc., Danbury, Conn., magnet wire manufacturer, has expanded its research laboratory to

provide complete testing under military and NEMA specifications.

Negotiations have been started for the merger of *Steiner-Ives Inc.*, Union, N.J., with *Temperature Engineering Corp.*, Riverton, N.J.

Orion Electronic Corp. has moved its executive offices and plant to Tuckahoe, N.Y. Manufacture of RF amplifiers, related power supplies and precision test instruments reportedly will be stepped up 200% at the new facilities.

A new company, *Hancock Telecontrol Corp.*, has been formed from the Telecontrol Division of Hancock Industries Inc., Jackson, Mich., to manufacture and market "Telecontrol" production-data equipment.

Print Ins. 41 on Reader Service Card for Advertisement on Pages 68 & 69.

Now get Class "F insulation varnis protection at a Class "B" price

Westinghouse B-185 polyester ins lating varnish provides outstandi protection. Class "F" protection- though it is priced with Class "B" va nishes. It's resistant to moisture, and acid. And it's tough but flexible

J-06705

Westinghouse also offers a Class
3" epoxy (B-172) that gives you
cellent chemical protection. Even
rsh alkalis won't affect it. What's
ore, it sets up hard without being
ttle . . . won't chip or crack.
Call your local Westinghouse Micarta
les office (listed in the Yellow Pages)
information and samples. Or write
Westinghouse Electric Corporation,
carta Insulating Materials,
afford, Penna. You can be
re . . . if it's **Westinghouse**

Micarta makes solid, flexible, liquid and powdered materials for all your insulation needs.

New Products

For further information on these products print the item number on the Reader Service Inquiry Card on the back cover. Fill out and mail the card —no postage is required. Insulation *will immediately forward your inquiry to the manufacturers concerned so that they can send you more information promptly.*

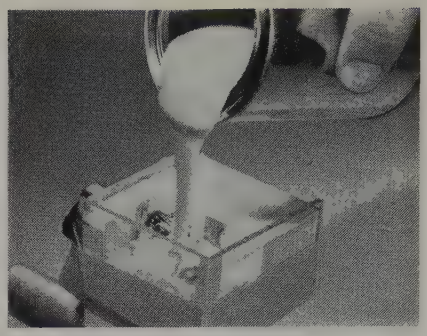
Phenolic Binder Improves Laminate Heat Resistance

New glass-fabric-reinforced laminates employing phenolic binders are said to compare favorably in heat resistance with laminates incorporating silicone binder. Features of the relatively low-cost material reportedly include higher flexural strength at all temperatures than do laminates with a silicone binder and weight loss and erosion properties comparable to glass-silicone laminate and superior to glass-melamine and glass-polyester laminates. A related quartz-phenolic laminate is claimed to have three times the erosion resistance of the glass-phenolic laminate but a somewhat lower flexural strength. Advantages are indicated in applications requiring a combination of stability against thermal shock, high strength-to-weight ratio, low thermal conductivity, and high percentage of strength retained more than 300 hrs at temperatures up to 500°F. The new laminates have already been used for such purposes as slot wedges, turbogenerator slip rings, arc chutes, panel boards, and class H insulation. A standard grade of laminate, H-5834, is being manufactured from the high temperature resistant phenolic resin. Westinghouse Electric Corp., Box 2278, Pittsburgh 30, Pa.

Print No. Ins. 100 on Reader Service Card

Fluid Silicone Rubber for Thick Section Potting and Encapsulation

A new silicone rubber for deep section potting, filling, embedding, and encapsulating of electronic components or assemblies is identified as "Silastic" RTV 601. This "pourable" material vulcanizes at room temperature to form solid rubbery sections of unlimited thickness. Supplied as a low viscosity fluid rubber, RTV 601 is said to flow readily and to completely fill narrow channels, cavities, and "hard-to-reach" sections of complex parts and assemblies. It reportedly cures without heat, pressure or moisture—even under totally confined air-tight conditions. It is reported that after vulcanizing for 24 hrs at about 77°F, parts or sections made from RTV 601 can immediately be put into full service at temperatures from —100°F to +500°F (—73.3°C to +260°C). Physical and electrical properties are stated to be uniform throughout the cured material, and it can be subjected to elevated temperatures without degradation or reversion. Another feature cited is excellent control over set-up time. By adjusting the catalyst concentration or the cure temperature, set-up time can be lengthened or reduced from the normal 12 hours as desired. Another feature reported is easy repair. Sections of RTV 601 enclosing trouble spots can simply be cut out. After repair, fresh RTV 601 is poured in place. Dow Corning Corp., Midland, Mich.



Print No. Ins. 101 on Reader Service Card

Vinyl Resins for Wire and Cable Extrusion, Other Electrical Uses

Four new and improved vinyl chloride polymers have a broad range of balanced properties. The new materials include a plastisol resin with excellent clarity and stability, designated "Opalon" 440, and the first three of a new Opalon 600 series of suspension resins with improved heat stability, color, and processability for extrusion, molding, and calendering. The Opalon 600 series is said to have electrical properties that meet UL specifications, excellent overall physical characteristics, excellent dry blending characteristics, and to combine outstanding color, clarity, and long-term heat stability with exceptionally fast processing at high quality levels. Opalon 660, a high molecular weight, fast-mixing resin is especially recommended for wire and cable extrusion compounds. Monsanto Chemical Co., Plastics Div., 100 Monsanto Ave., Springfield, Mass.

Print No. Ins. 102 on Reader Service Card

Flexible Curing Agents For Epoxy Resins

Three new flexible curing agents for epoxy resins are described as amine-terminated aliphatics with controlled and limited functionality. Experimental hardeners X-3483.1, X-3483.2, and X-3483.3 are very low viscosity, almost colorless liquids suggested for use to control flexibility, viscosity, and exotherm in both conventional epoxy resins and new flexible epoxy resins. Particular application in epoxy coatings, castings, adhesives, and laminates is expected. Information and samples available. The Dow Chemical Co., Midland, Mich.

Print No. Ins. 103 on Reader Service Card

Asphalt Saturated Glass-Asbestos Paper in Roll, Sheet, or Tape Form

A new type of asphalt saturated base paper is said to be highly purified and to combine unusual strength with fine texture. The paper is available in rolls, sheet, or tape form. Style #7505 is a combination of glass cloth and a long-fibered asbestos paper and is available in .008″, .010″, .015″, and .020″ gauges. Weight of the paper is 22 lbs per 100 sq yds in .008″ gauge. The base paper is a composition of 35% asbestos and 65% glass fibers. Tensile per 1″ is 50 lbs lengthwise. Average tear strength is 90 grams machine direction, 350 grams cross machine direction, in the

Print Ins. 41 on Reader Service Card for Advertisement on Pages 68 & 69.

.010″ gauge. A variety of properties can be obtained through manufacturing controls to fit specific applications. Because of the unusual ability of the paper to receive saturants, the addition of selected resins or treating compounds can impart unique properties to the end product. Asbestos Textile Div., Raybestos-Manhattan Inc., Manheim, Pa.

Print No. Ins. 104 on Reader Service Card

Laminate Reduces Frequency Drift

Frequency change, commonly referred to as "drift," occurs during heating and aging of electrical components. A new "Insurok" laminated plastic grade, designated T-744, is said to have unusually stable dielectric properties which help reduce the tendencies of TV tuners to "drift." It is a hot punch, paper base phenolic laminate, available in natural tan and in thicknesses from 1/32″ to ⅛″. It is also claimed to have XXXP-plus properties and can be punched to intricate shapes required in the switch wafer field. Excellent dimensional stability and a very low cold flow are also reported. These characteristics also suggest use of T-744 as insulators in spring pile-ups as found in relays and some switches, particularly in critical applications. Richardson Co., 2861 Lake St., Melrose Park, Ill.

Print No. Ins. 105 on Reader Service Card

Higher Flash Point Insulating Oil For Transformers and Circuit Breakers

An improved universal electrical insulating oil for transformers and circuit breakers features a flash point 10°C higher than previous insulating oils. The oil has a flash point of 145°C (293°F); standard insulating oil has a flash point of 135°C (275°F). This is said to be particularly significant with the present trend to higher operating temperatures of 65°C rise or higher permitted by the introduction of stabilized cellulose insulation. The new oil's physical, chemical, and electrical properties make it applicable on all equipment where the conventional insulating oil was used. It is compatible with previous oil and, when mixed with it, the flash point will be that of the lower flash point oil. Westinghouse Electric Corp., Box 2278, Pittsburgh 30, Pa.

Print No. Ins. 106 on Reader Service Card

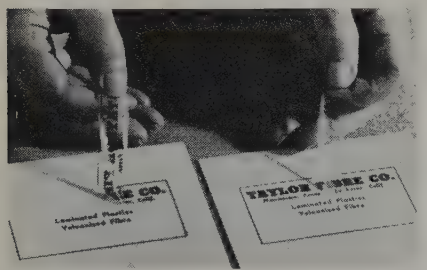
Epoxy Transfer Molding Compound for Quality/Volume Encapsulation

Fast, accurate, low cost encapsulation of electrical components at high production rates, using transfer or compression molding methods, is claimed with the new Randac epoxy molding compound S-7010. Engineered for use on coils, small transformers, resistors, capacitors, and other components where large volume prohibits economical use of liquid casting techniques, the new S-7010 reportedly features low molding pressures and temperatures, good resistance to thermal shock, and long shelf life (more than 3 months) at room temperatures. Other advantages cited include: soft flow, minimizing hazard of lead wire breakage or component distortion and allowing use of low cost molds; average mold time of 1 to 5 minutes; stable electrical properties; low water absorption; and excellent class F temperature stability. Mitchell-

Rand Manufacturing Corp., 51 Murray St., New York 7.
Print No. Ins. 107 on Reader Service Card

Finish Improves Printability Of Silicone and Epoxy Laminates

A new finish reportedly improves the printability and other adhesion requirements of silicone and epoxy laminated plastics. Known as "B Finish," the new process produces a slightly dulled surface which is said to hold all types of inks commonly used to print panel boards and other laminate parts, whether applied by silk screen, rubber stamp, or other printing methods. It is also claimed to provide better adhesion for metal foil in metal-clad laminates. Specification of B Finish on laminates is stated to eliminate the need for costly sanding of laminated plastics which are particularly difficult to print, such as silicone and epoxy resin laminates. Photo shows resistance of new finish (right)



to removal of printing by tape. The B Finish may be specified as an optional finish at no extra cost on any standard size sheets and on parts fabricated from these sheets. Taylor Fibre Co., Norristown, Pa.
Print No. Ins. 108 on Reader Service Card

Low-Loss Electrical-Grade Polyethylene

A new polyethylene compound with superior low-loss electrical properties specifically designed for primary insulation of transoceanic submarine telephone cable systems now being planned may prove valuable in high voltage applications and other areas where ultra-critical control of properties is required. The material, "Bakelite" DFDA-0173, is characterized as an unmodified, very high molecular weight polyethylene compound of exceptional purity containing only antioxidant. The composition, electrical characteristics, and other pertinent properties of the new compound reportedly are controlled within rigidly narrow limits. This is of vital importance in the insulation of long conductors where variation in the dielectric constant, dissipation factor, and even the thickness of the insulation reduces the efficiency of the cable. Typical properties of the new material are said to include a dissipation factor of .00012 at 23°C and 10^3 to 10^6 cycles and a dielectric constant of 2.283 at 23°C and 10^3 to 10^6 cycles. Union Carbide Plastics Co., Div. of Union Carbide Corp., 270 Park Ave., New York 17.
Print No. Ins. 109 on Reader Service Card

Red Synthetic Insulating Varnish In Aerosol Containers

The Champion Sprayon brand of red synthetic insulating varnish, a quick-drying insulating varnish that provides an oil and water-proof protective film for insulating windings, coils, switchboard parts, commutator ends, and other similar electrical applications, is now available in 16 oz aerosol containers as well as in bulk. The varnish reportedly offers good di-

electric strength (1000 vpm) and possesses superior arc resistance and nontracking properties. Champion Bronze Powder & Paint Co. Inc., Chicago 14.
Print No. Ins. 110 on Reader Service Card

Clear Epoxy Adhesive

A "Reading Clear," room temperature curing epoxy patching and bonding material is available as "Epoxy-Patch" kit No. 0151. Both resin and hardener are packaged in flexible tubes for greater handling ease—just squeeze-out equal length beads and mix. The new kit is recommended for glass-to-glass, "Pyroceram"-to-glass, and metal-to-glass bonding, and for repair of printed circuits, strain gauges, etc. Bulletin A-505A available. Hysol Corp., 322 Houghton Ave., Olean, N. Y.
Print No. Ins. 111 on Reader Service Card

Economy Grade "Teflon" Tape

"Fluorolin" 101-R tape is claimed to save 30 to 40% in the cost of Teflon pressure-sensitive tape and to be ideal for minimized electrical requirements. Fluorolin 101-R reportedly can be used for outer protective wrappings, for release and non-stick surfaces, for protective coatings for ease of cleaning, for wear strips or discs, and as a release material for molds. The Joclin Mfg. Co., Lufbery Ave., Wallingford, Conn.
Print No. Ins. 112 on Reader Service Card

Combination Curing Agent and Flexibilizer for Epoxy Resins

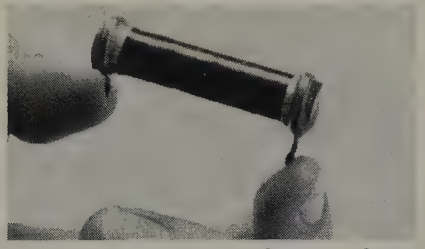
A linear polymeric anhydride that functions as a flexibilizer as well as curing agent for epoxy resins, called "Harcure A," reportedly imparts excellent thermal shock properties as well as good high temperature electrical properties to cured epoxy recipes. It can be formulated with liquid or solid epoxy resins into a single component system said to have prolonged shelf life at room temperature. Product Development Dept., Harchem Div., Wallace & Tiernan Inc., 25 Main St., Belleville 9, N. J.
Print No. Ins. 113 on Reader Service Card

First Chlorinated Polypropylene

The chemical industry's first chlorinated polypropylene is said to have a broad field of potential uses, including coatings and adhesives. The new film-forming polymer, "Parlon" P, reportedly has excellent heat resistant properties and also may be applicable in flame-retardant compounds. In addition to heat and light stability, this chlorinated polymer also is said to have excellent solution color, to produce clear water-white films, and to have good chemical resistance. In physical form, the product is a white, free-flowing powder and is soluble in many common solvents. Hercules Powder Co., 910 Market St., Wilmington 99, Del.
Print No. Ins. 114 on Reader Service Card

Diallyl Phthalate Varnishes

Increased versatility of "Dapon" diallyl phthalate resins as insulating materials for electrical and electronic equipment is indicated with the development of varnishes based on these resins. The varnishes can be used for coating, sealing, dip encapsulation, and laminating applications. The cured resin coatings are said to offer excellent resistance to moisture, chemicals, corrosive gases, fungus, weathering, and aging over a wide temperature range. They show particular promise for protective coatings on ca-



pacitors, resistors, transformers, form-wound coils, motor windings, transistors, diodes, and similar parts. Good cures reportedly can be obtained at 320°F for 15 minutes. Coatings on heat-sensitive parts can be cured at temperatures as low as 212°F when the time is extended to 16 hours. Food Machinery and Chemical Corp., Chemical & Plastics Div., 161 East 42nd St., New York 17.

Print No. Ins. 115 on Reader Service Card

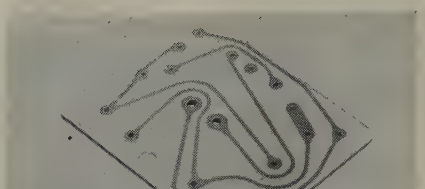
Paper-Nylon Sheet Insulation For Hermetic Applications

A new laminate of 100% rag paper and nylon is designed for use as electrical insulation in hermetic applications. The nylon film is extruded directly onto the paper in a molten state, eliminating the need for an adhesive. Test values for a sheet .010″ thick with a .005″ nylon film reportedly show a tensile strength of 144 psi in machine direction and 90 psi in cross machine direction, electric strength of 1120 vpm, a film-paper adhesion of 2.25 lbs per 3″ width, Elmendorf tear of 990 gm in machine direction and 1120 gm in cross machine direction. Rogers Corp., Rogers, Conn.

Print No. Ins. 116 on Reader Service Card

Non-Warping, High-Reliability Printed Circuit Boards

A non-warping, high reliability printed circuit utilizing "Mykroy"



glass-bonded mica with deposited copper is being developed for ferrite memory systems, radar circuitry, substrate amplifier systems, missile control circuitry, and switching commutators. Mykroy glass-bonded mica is a dense, rock-like material resulting from the fusion of molten electrical glass and mica. Its combination of electrical and mechanical properties reportedly make it superior for use in printed circuitry since it has infinite dimensional fidelity, does not outgas or carbon track, will not absorb moisture or support combustion, is radiation resistant, and will maintain a volume resistivity of plus 10^5 ohms/cm through 300°C. The .0005″ copper conductive path may be located within holes (which eliminates eyelets), in grooves or counterbores on either or both surfaces of the circuit board. Electronic Mechanics Inc., 101 Clifton Blvd., Clifton, N. J.

Print No. Ins. 117 on Reader Service Card

Versatile Fluorine-Containing Thermoplastic

A new vinylidene fluoride resin, "Kynar," heretofore designated as RC-2525 resin, is a fluorine-containing thermoplastic resin designed for long life and high performance in environments which degrade less stable materials. Field trials reportedly show Kynar to be easily extruded and molded into many complex shapes using standard equipment. Data obtained from tests and evaluations are said to show that Kynar is mechanically strong and tough, resistant to distortion and creep at low and high temperatures, highly resistant to the attack of corrosive chemicals, flame resistant, and stable under extreme conditions of weather and ultraviolet radiation. Kynar will also be marketed later as organosols and solutions in high boiling organic solvents. It is stated that Kynar in the form of rod, tube, and sheet can be readily cut, machined, sealed, welded, and formed into almost any design. Of primary interest to electrical equipment designers is the use of thin wall jackets for wire and cable where Kynar's toughness, high surface resistivity, weatherability, and flame resistance are significant properties. In addition, thin wall tubing of Kynar can be used as sleeving for wire and cable terminals, and as protective coatings over various electrical components such as resistors. Product information, price schedules, samples, and technical service available. Pennsalt Chemicals Corp., Research Products Development Dept., P. O. Box 4388, Philadelphia 18, Pa.

Print No. Ins. 118 on Reader Service Card

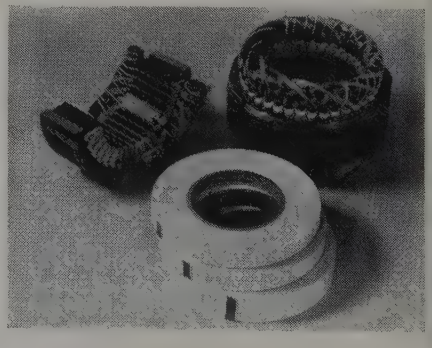
Vinyl Compound for Insulating Appliance and Hook-Up Wire

A new vinyl compound is designed to meet the needs for 90°C appliance wire, hook-up wire, and government specifications for 1/32″ and 1/64″ wall thickness. Compound #9101 reportedly passes UL requirements after 7 days aging at elevated temperatures and also meets CSA requirements of 14 days at 121°C with a very high margin of safety. It is stated to have outstanding high and low temperature characteristics. The Blane Corp., Canton, Mass.

Print No. Ins. 119 on Reader Service Card

Glass Filament/Acetate Film Tape For Electrical Insulating and Holding

A new electrical holding tape features acetate film insulation, glass filament strength, and a solvent resistant, thermosetting adhesive. Called "Scotch" brand electrical tape No. X-1131, it is designed to replace cotton cloth and paper tapes in many holding applications, at less cost and with improved holding and insulating qualities. The new tape combines the

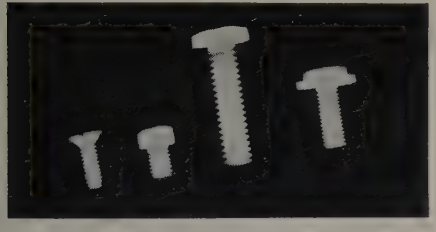


electric strength and purity of a 1.5 mil acetate film backing with the physical strength of glass filaments. The tape may be used on all fine wire applications. It will not cause corrosion under prolonged exposure to humidity and electrical stress, it is reported, and, after curing, resists softening at high temperatures, or "throw out" caused by high speed rotating equipment. X-1131 is a 7 mil tape with an electric strength of 5,000 v, tensile strength of 130 lb/in, and an electrolytic corrosion factor of 1.00. Dept. W1-29, Minnesota Mining and Manufacturing Co., 900 Bush Ave., St. Paul 6, Minn.

Print No. Ins. 120 on Reader Service Card

Molded 'Delrin' Screws for Electrical/Electronic Uses

A wide range of Delrin screws are said to be molded to precise tolerances and exacting specifications. The new Delrin line parallels the types and sizes of GRC molded nylon screws. Delrin acetal resin reportedly has a combination of properties not found in any other single material; including many strength characteristics approaching those of metals, excellent electrical insulation properties, unusually high tensile strength, rigidity and resistance to deformation, and high dimensional stability over a wide range of environmental conditions. Its resistance to creep, particularly above 150°F (66°C), is claimed to be far superior to that of most other thermoplastics. The screws are available in a wide selection of types, threads, and lengths. Gries Reproducer Corp., New Rochelle, N. Y.



Print No. Ins. 121 on Reader Service Card

High Viscosity Epoxy Novolac Resin

A new epoxy novolac has a viscosity in the range of 500,000 cps compared to 120,000 cps for D. E. N. 438, a conventional epoxy novolac for high temperature service. For handling ease, experimental resin X-2638.6 is available only as an 85%

solution in methyl ethyl ketone. The high viscosity of this resin reportedly permits making prepreg fabric without the need for carefully controlled B-staging and using this fabric for matched-die molding under heavy pressures without excessive resin flow-out. Prepreg tack is stated to be so slight after solvent removal that fabric webs can often be rolled and stored without an interleaving release film. Blends of resin X-2638.6 with D. E. N. 438 and conventional epoxy resins are said to provide a range of viscosities, while maintaining or improving high temperature performance and chemical resistance. Samples and data sheets available. The Dow Chemical Co., Midland, Mich.

Print No. Ins. 122 on Reader Service Card

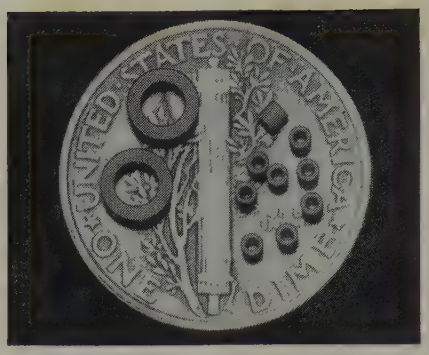
Modified Polybutadiene for Wire & Cable Insulation

A new modified polybutadiene polymer, "Hycar" 1000X145, is stated to have excellent abrasion resistance, to resist embrittlement at temperatures as low as —85°F (—65°C), and to have moderate resistance to the effects of fuels, solvents, and chemicals. These characteristics, coupled with excellent electrical properties and ozone resistance reported, make it an ideal material for use in the electrical wire and cable field. The use of Hycar 1000X145 in wire and cable applications could eliminate the need for different materials for use in the primary insulation and the protective sheath. Samples and technical data available. B. F. Goodrich Chemical Co., 3135 Euclid Ave., Cleveland 15, Ohio.

Print No. Ins. 123 on Reader Service Card

Sub-Miniature Alumina Ceramics

High alumina ceramics are now being produced in sub-miniature forms as small as .050″ OD x .030″ ID x .045″ long. They are being fabricated on a volume production basis for use in the manufacture of semi-conductor assemblies. Parts and components of the Diamonite material, which contains up to 97% alumina oxide, reportedly possess high dielectric strength at high frequencies and elevated temperatures. They are also said to be non-magnetic, non-conductors of electricity, vacuum tight, and

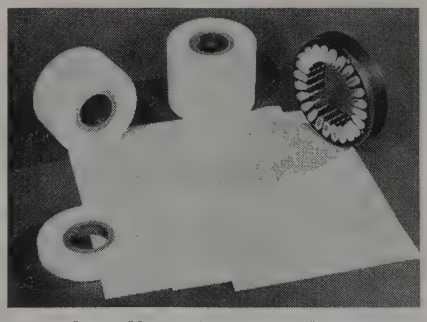


are readily metallized. It is stated that the material has high heat resistance and will not burn, corrode, deteriorate, or melt under operating conditions which adversely affect other materials. It is further characterized by excellent physical properties with extremely high compression strength and good resistance to mechanical shock. Bulletin TC-1 available. Diamonite Products Mfg. Co., Shreve, Ohio.

Print No. Ins. 124 on Reader Service Card

Adhesive-Free Web/Film/Web Polyester Laminate Dielectric

A new polyester laminate employs a triplex construction—a web/film/web lamination—without an adhesive or other bonding agent. Called "Irvington" brand polyester laminate No. 2541, it reportedly will not delaminate in contact with solvents used in varnish impregnation. The absence of glues, adhesives, and impregnants is stated to provide improved resin or

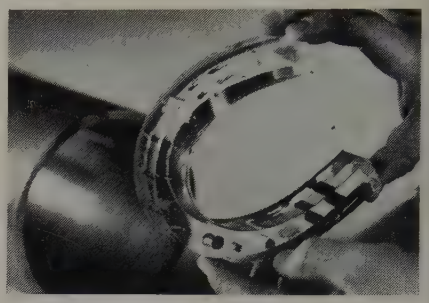


varnish-to-film adhesion, eliminating voids or gaps which encourage moisture attack within impregnated or encapsulated units. Varnishes or epoxy resins are absorbed easily by the nonwoven polyester web outside layers, establishing a tight bond to the inner layer of film. For typical applications such as slot, phase, and layer insulation, No. 2541 reportedly has the right amount of rigidity and "springback" for slot wall conformance, making insertion of coil windings easy. Dept. W1-22, Irvington Div., Minnesota Mining and Manufacturing Co., 900 Bush Ave., St. Paul, Minn.

Print No. Ins. 125 on Reader Service Card

Transparent Silicone Resin Encapsulant is Flexible

"Sylgard" 182 resin, a new silicone encapsulating material that permits visual inspection of circuits and components within potted, embedded, or encapsulated assemblies is applied as an almost colorless liquid—after blending with its curing agent. It cures in place, even in totally confined enclosures, to form a transparent mass



having outstanding dielectric properties, good moisture resistance, flexibility, and toughness. Curing time for 182 resin can be varied by changing the curing temperature. At 150°C, it cures in 15 minutes; at 65°C, four hours; at 25°C, three days. Components and circuits encapsulated in 182 resin are clearly visible, simplifying replacement or repair procedures. The cured resin can be cut away and when new resin is poured over the repaired area, it will adhere to the original material, restoring the encapsulant to the original condition. Dow Corning Corp., Midland, Mich.

Print No. Ins. 126 on Reader Service Card

Copper-Clad Laminate for Microwave Printed Circuitry

A new copper-clad laminate is intended primarily for microwave and UHF printed circuitry. "Tellon" 3A is reported to be a completely isotropic material with a low dielectric constant of 2.36±.01 and a dissipation factor of .0002. Excellent moisture and chemical resistance and a minimum peel strength of 5 lb/in with a nominal of 15-20 lb/in are cited. Tellon 3A can be cold-punched, drilled, and machined as required. Eyelets can be set either flush or below the surface and the material may be soldered by conventional tech-

niques including roller-coating. Operating temperatures claimed are 250°F (127°C) continuously and 500°F (260°C) intermittently. Military Electronics Div., Tell Manufacturing Co., 520 Cary St., Orange, N. J.

Print No. Ins. 127 on Reader Service Card

All-Weather Electrical Tape

New "Scotch" brand 8.5-mil all-weather electrical tape No. 88, packaged in metal cans, reportedly has been specially designed for cold weather application, yet retains its handling and storage ability at summer temperatures. At 0°F, pliability,

elongation, conformability, and adhesion are said to be comparable to regular plastic tapes at normal temperatures, while the same degree of resistance to atmospheric and chemical corrosion is maintained. Minnesota Mining and Manufacturing Co., 900 Bush Ave., St. Paul 6, Minn.

Print No. Ins. 128 on Reader Service Card

Hermetic Seal Headers For High Reliability

A new line of terminal feed-through sub-miniature type FT series headers reportedly provide a high reliability super-hermetic seal at temperatures from —325 to +1200°F (—198.33 to 649°C), high pressures, and may be used in nuclear environments. Available in standard single-pin, two-pin, and six-pin configurations. In

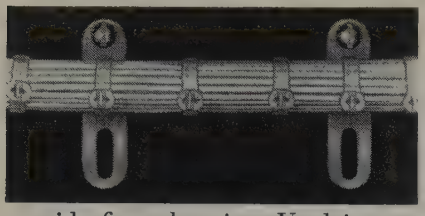
addition, a wide variety of sizes and pin arrangements may be designed on special order. Characteristics of PSC headers are made possible by the use of PSC-Durock seals. PSC-Durock is a silico-ceramic sealing, insulating,

and encapsulating material developed for use in nuclear environments, high temperatures, extreme pressures, and corrosive environments. Bulletin No. FT-1 available. Physical Sciences Corp., 389 N. Fair Oaks Ave., Pasadena, Calif.

Print No. Ins. 129 on Reader Service Card

Premountable Harness Clamp

A new premountable harness clamp takes a complete range of harness sizes up to 4″. Once the clamp is installed, it does not have to be unmounted should the harness need reworking. Two mounting bolt holes



provide firm clamping. Used in conjunction with "Ty-Rap" cable ties and straps, this one clamp and a Ty-Rap are claimed to replace 52 sizes of conventional clamps. Bulletin TR3 available. The Thomas & Betts Co., 36 Butler St., Elizabeth, N. J.

Print No. Ins. 130 on Reader Service Card

High Voltage Insulated Couplings For TV and Industrial Applications

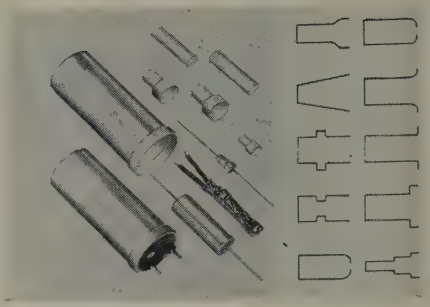
New AK-4160 "Bakelite" insulated couplings are said to safeguard operating personnel and greatly reduce ground capacitance. Ability to withstand over 30 kv before flashover is claimed. Ideal for TV and general in-

dustrial applications, they are produced from Bakelite throughout except for the integrally molded, stainless steel screw driver tip which fits all standard, slotted potentiometer shafts. Supplied with complete mounting hardware. Jan Hardware Mfg. Co. Inc., Dept. I, 38-01 Queens Blvd., Long Island City 1, N. Y.

Print No. Ins. 131 on Reader Service Card

'Mylar' Jackets Insulate Variety Of Parts Fast and Economically

Fast, easy, and very economical insulation of a wide variety of elec-



trical/electronic parts is claimed possible by means of newly developed Mylar film jackets. Available in practically any shape or size, they are said to be ideal for hermetic sealing on production lines or automated assembly operations. The jackets are fabricated from Mylar film laminated to polyethylene which permits them to be shrunk or expanded without breaking down the material structure. The polyethylene actually flows with the Mylar to make a firm bond and prevent separation. The new jackets are now being used on capacitors, coils, screws, and many other parts where insulation against electrical effects and/or corrosion is required. They are also used to eliminate expensive handwrapping with pressure-sensitive

insulation. Precision Paper Tube Co., Dept. IN-2, 2035 W. Charleston St., Chicago 47.
Print No. Ins. 132 on Reader Service Card

Vinyl Protectors for Miniature Rectangular Electronic Connectors

Effective, all-around protection for miniature rectangular, electronic connectors during manufacture, shipment, and storage and while in service reportedly is provided by a new line of vinyl plastic protectors. In addition to protecting electronic con-

nectors from impact damage, the close-fitting rectangular caps keep out moisture, dust, and contamination and insulate against shorting out and the possibility of electrical shock to technicians. Plastics Dept., S. S. White Industrial Div., 10 East 40th St., New York 16.
Print No. Ins. 133 on Reader Service Card

Fluorocarbon Marking Inks

New "Vanflex" marking ink for applying spiral stripes to FEP "Teflon" insulated wire is based upon FEP fluorocarbon resin. Because FEP Teflon will form a continuous film at a lower temperature than TFE Teflon, it is only necessary to heat the stripe to 600°F to sinter the Teflon in the coating. These inks are applied by means of conventional striping machines. Samples available. Interchemical Corp., Color & Chemicals Div., Englewood, N. J.
Print No. Ins. 134 on Reader Service Card

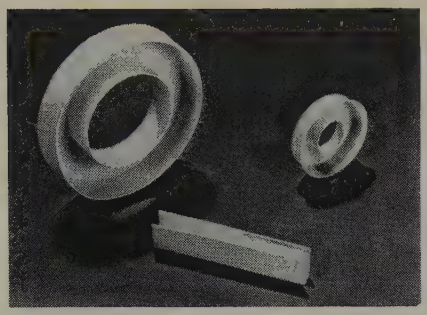
Moisture Remover and Corrosion Inhibitor

A new moisture repellent reportedly offers protection wherever the corrosive effect of moisture may cause malfunction or permanent damage. "Calfonex" formula 78-A rapidly displaces water and moisture, penetrates to bare material surface, removes rust and contamination, and forms a con-

tinuous protective film that seals. It is said to be effective for electrical and electronic components and equipment, rubber, plastic, ceramics, etc. The non-flammable material is available in 16 oz aerosol cans for spraying, and in 1 and 5 gallon drums for dipping, brushing, or power-spraying. The Falcon Corp., G. P. O. Box #1035, Brooklyn 1, N. Y.
Print No. Ins. 135 on Reader Service Card

1800°F Insulating Preforms

Electrical insulation preforms for high temperature and radiation applications consist of "Refrasil" insulators with phenolic resins. Refrasil is a vitreous silica fiber cloth. Physical properties and insulating values reportedly are not adversely affected in 1800°F

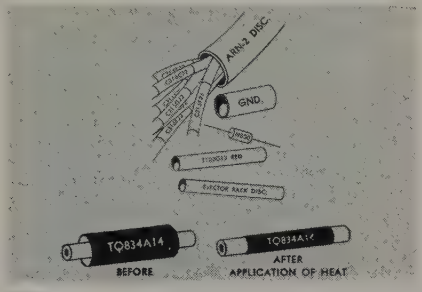


(982°C) applications and thermal and mechanical properties are stable in exposure to radiation. Stevens Products Inc., 86-88 Main St., East Orange, N. J.

Print No. Ins. 136 on Reader Service Card

Pre-Printed Shrinkable Sleeving Markers

"Shur-Codes" are the printed insulation sleeving that is slipped over



wires, cables, and harnesses for permanent identification. They are supplied in expanded form, and with the application of heat, they shrink to a tight fit of predetermined size. Westline Products Div., Western Lithograph Co., 600 East 2nd St., P. O. Box 2980 Term. Annex, Los Angeles 54, Calif.

Print No. Ins. 137 on Reader Service Card

Hook-Up Wire for Use to 1000°F

An experimental lead wire is reported to be capable of reliable operation up to 1000°F (538°C). It is also stated that the wire has been subjected to extensive heat-cycle tests without destruction to the insulation, that it will maintain a minimum dielectric strength of 1000 v, that it has been successfully sparktested at 2000 v, that insulation resistance is maintained at above 10,000 megohms, and that flexibility is more than satisfactory. Available in single and multiconductor constructions. Service Cable & Wire Inc., 2051 Pontius Ave., Los Angeles 25.

Print No. Ins. 138 on Reader Service Card

New Vernier on Micrometer Converts to Ten-Thousandths

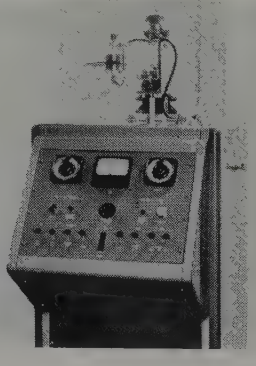
Dead-weight thickness micrometer can now be equipped with a vernier scale on end of indicator blade to permit direct readings of ten-thousandths of an inch from the one-thousandths dial graduations. Insert photo shows close-up of vernier scale. Micrometer with this vernier brings the advan-

tage of the gravity-descent anvil and the larger thickness capacity (½") to the fields of critical measurement. This micrometer, with 8 psi meets ASTM and TAPPI Standards. E. J. Cady & Co., 630 North Harlem Ave., River Forest, Ill.

Print No. Ins. 139 on Reader Service Card

Insulation Materials Tester Provides up to 50 KV at 2 KVA A-C

The new high voltage "Hypot" model 4510 tests a wide range of both liquid and solid electrical insulating materials to ASTM and Federal specifications. Test potential is continuously variable from 0 to 50 kv at 2 kva a-c. Rate of rise is motor-driven and fully adjustable from 300 to 3000 volts per second. Dwell time for test voltage on the test sample is timer controlled and may be set to meet

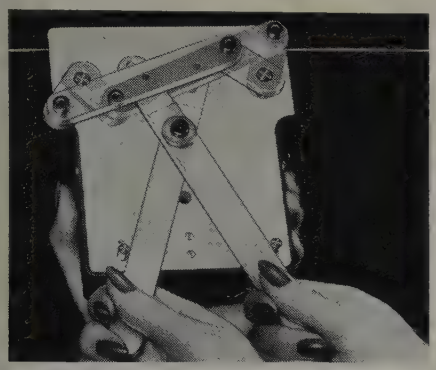


individual test requirements. A full line of interchangeable test fixtures for samples of insulating solids, tapes, oils, and other materials is available for the model 4510. An electronic memory unit records voltage breakdown. Associated Research Inc., 3777 West Belmont Ave., Chicago 18.

Print No. Ins. 140 on Reader Service Card

Meter for Measuring Tension In Moving Wires

A new tension meter is said to permit quick and automatic tension measurement of any filamentous material under critical conditions. Compound lever action is claimed to make the insertion of a fast-moving wire

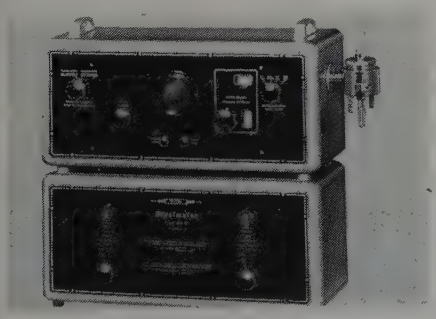


into the 3-roller system simple under reliable and reproducible conditions. It allows sustained accuracy independent of the operator, and has many safety features. Tensitron Inc., P. O. Box 185, Harvard, Mass.

Print No. Ins. 141 on Reader Service Card

Instrument for Measuring Dipole Moment and Dielectric Constant

The Dipolemeter DM 01 is a measuring instrument intended for the exact determination of the molecular electrical dipole moment of liquids by precise measurement of the dielectric constant. It also is said to permit very accurate determinations of the dielectric constant for purity tests, dielecric analyses, chemical investigations, etc., because of its extremely sensitive measuring range of 2×10^{-5} for liq-



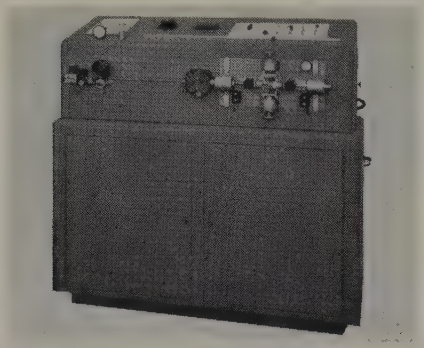
uids. Interchangeable cells and micrometer electrodes are available for the various media and substances to be analyzed. Catalogs available. Kahl Scientific Instrument Corp., P. O. Box 1166, El Cajon, Calif.

Print No. Ins. 142 on Reader Service Card

Automatic Wire Stripper With Reduced Set-Up Time

Quick-change devices that reduce set-up times are featured in the new model 810A automatic wire stripper. The machine is air-powered and electrically controlled. It is said to cut and strip 32 to 12 AWG wire in lengths from 1 inch to 300 ft at speeds of up to 8,000 pieces per hour. It may be used to strip "Teflon," fiber glass, asbestos, and "Kel-F" as well as PVC, rubber, and other soft insulations. While designed principally for single conductor wire, it will also strip coaxial cable. Eubanks Engineering Co., 260 N. Allen Ave., Pasadena, Calif.

Print No. Ins. 143 on Reader Service Card



Safety Tape Protects Hands

New green "Guard-Tex" is a self-adhering safety tape which can be used to protect fingers, hands, forearms, and wrists against cuts, burns, and abrasions. It is suitable for use in such operations as transformer lamination, pigtailing, handling hot or sharp objects, etc. General Bandages Inc., Morton Grove, Ill.

Print No. Ins. 144 on Reader Service Card

Aluminized Silicone Rubber-Glass Protects Electrical Units from Heat

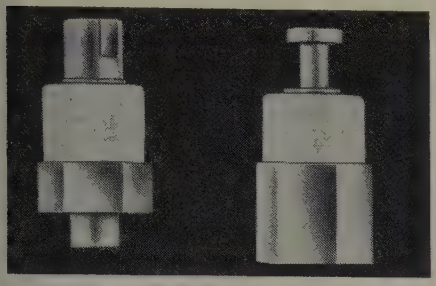
Protection of electronic and electrical equipment and personnel from high radiated heat is possible with a new aluminized silicone rubber coated glass cloth. Reportedly reflecting more than 90% of the infrared rays generated by a thermal source, and absorbing much of the remaining heat, "Irvington" brand SRGA fabrics can be used as a protective curtain to shield complex electronic gear, personnel, cables, heavy equipment, sensitive circuits, and expensive cable from destructive heats. Aluminized fabrics SRGA 0208 and SRGA 0214 are .008 and .014 inches in caliper, weigh 10 and 14 oz/sq yd, respectively, and are said to be suitable for use in continuous ambient temperatures ranging from —100°F to 500°F, and for short periods at 700°F. SRGA fabrics are available with the plain silicone rubber coated side either cured or uncured. Special treatment makes it possible to bond either side under heat and pressure for applications where this is desirable. Dept. WO-502, Irvington Div., Minnesota Mining and Manufacturing Co., 900 Bush Ave., St. Paul 6, Minn.

Print No. Ins. 145 on Reader Service Card

"Teflon" Stand-Off Insulators

The body of each of two new stand-off insulators is fabricated of Teflon. The insulators are supplied as insu-

lated tie-points in circuit wiring, and are said to offer low-loss, high-frequency service in radar, television, and other electronic equipment. They are also reported to be unaffected by humidity, mechanical shock and vibration, and to be designed for ambi-

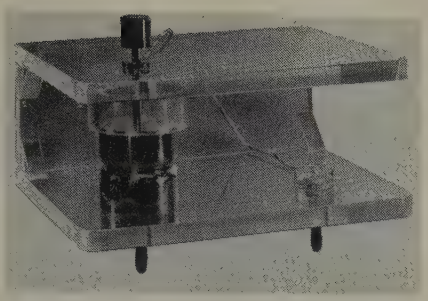


ent temperatures from —110°F to +500°F (—79°C to 260°C), pressure altitudes from 0 to 80,000 ft. Garlock Electronic Products, Garlock Inc., Camden 1, N. J.

Print No. Ins. 146 on Reader Service Card

Insulation Materials Test Fixtures For ASTM Specifications

A line of interchangeable fixtures has been developed for testing the dielectric strength of insulating solids, films, sheets, and liquids in accordance with applicable ASTM stand-



ards. Fixtures with electrodes of various sizes and designs meet ASTM specifications for thin sheet material; cloth tapes; thick, solid materials; sheet and plate materials; friction and rubber plates; solid compounds; and laminated sheets. An adapter cup makes possible use of these electrodes to make tests that require the sample be placed under oil. Bulletin 4-60.4 available. Associated Research Inc., 3777 West Belmont Ave., Chicago 18.

Print No. Ins. 147 on Reader Service Card

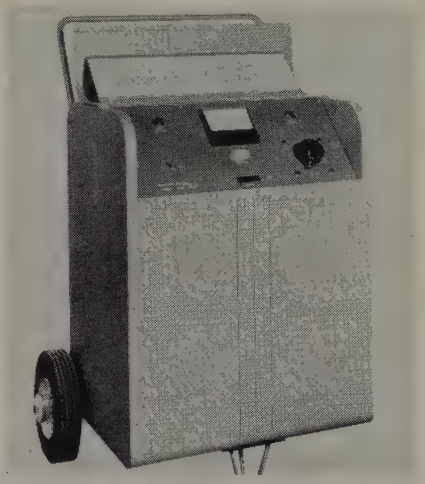
Insulation Test Equipment

Several standard and multi-range models have been added to a line of dielectric strength testers. All model PA instruments provide rate-of-rise adjustable from the control panel and built-in test compartments with complete interlocking. A variety of interchangeable plug-in electrode systems are available. Schering bridge equipment and accessories for measuring capacity and power factor of dielectric materials under high-voltage stress can also be provided. Industrial Instruments Inc., 39 Commerce Rd., Cedar Grove, N. J.

Print No. Ins. 148 on Reader Service Card

A-C Dielectric Strength Test Sets In Mobile Cabinets

A new series of mobile high-voltage a-c testers of insulation dielectric

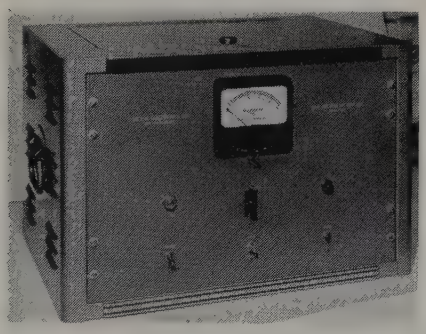


strength is designed for laboratory, quality control, and production applications. These sets are stated to meet requirements for development work on insulating materials, electrical components, and completed assemblies, including motors, generators, transformers, switchgear, and cables. Unusual safety provisions as well as quick set-up are said to make them equally suitable for testing in production areas or at field locations. A selection of several models with outputs up to 20 kv at 10 kva and to 30 kv at 5 kva is offered. Larger ratings are available in console models. Associated Research Inc., 3777 West Belmont Ave., Chicago 18.

Print No. Ins. 149 on Reader Service Card

A-C Dielectric Test Set With Motorized Output

Conforming to ASTM D149-59T standard, a HV a-c dielectric test set is a one-piece unit with a motorized output control and a continuously adjustable output of 0-15 kv rms, and 2 kva capacity. Model K15-2M also



features low waveform distortion (below 5%); dual scale kv meter connected directly at the output for accurate voltage indication; a "raise-lower" panel switch for the motorized output control; and complete convenience and safety controls. The table top cabinet measures 22" x 16" x 18" and weighs approximately 110 lbs. Price is $1190. Peschel Electronics Inc., Towners, Patterson, N. Y.

Print No. Ins. 150 on Reader Service Card

High Voltage Insulation Tester

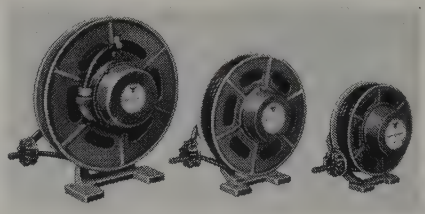
A new portable non-destructive high voltage insulation tester with a continuously adjustable output of 0 to 5000 volts rms, model HV53, features a calibrated transistorized high voltage circuit breaker with a continuously settable trip point between

10 μa and 3000 μa. The unit is arranged for either manual, foot switch, or high speed remote control operation and either automatic or manual resetting after a leakage overload. A panel selector switch provides for guarded or unguarded testing. Model HV53 is self-contained in a completely insulated, high resistance case and panel, and is only 7½"W x 3⅛"D x 8½"H. Weight is 8½ lbs. Price is $250 FOB NYC factory. Opad Electric Co., 43 Walker St., New York 13.

Print No. Ins. 151 on Reader Service Card

High Capacity Cable Reels

Several standard and modified standard reels to pay out and take up electrical cable in lengths from 15 ft to over one mile of cable are available in from one through 90 conductor capacity. The reels are designed for

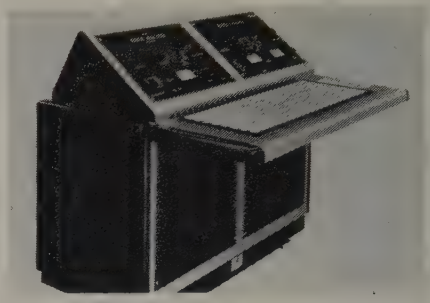


use on cranes, hoists, conveyors, floor maintenance machines, trucks, machine tools, and portable electric equipment, and in shipyards, mines, mills, industrial plants, transport terminals, and other applications where dependable retractable action is required to neatly store and protect cable from abuse. Reels are made of modern alloy metals to combine maximum strength and safety with minimum weight. They are also said to be dust and moisture tight and are also available in explosion-proof construction. Aero-Motive Mfg. Co., 1801 Alcott St., Kalamazoo 24, Mich.

Print No. Ins. 152 on Reader Service Card

Automatic Circuit Analyzer for A-C and D-C Insulation Testing

Both a-c and d-c testing of wiring harness and electrical cabling can be performed automatically by the new model 20 automatic circuit analyzer. Designed to meet military specifications for a-c testing, it reportedly provides fully reliable dielectric measurements, detects potential breakdowns and arc-overs before they occur, and indicates dead shorts instantly with no damage to the cable. Dwell time is said to be fully adjustable, and compensation for accumulated circuit capacitance is automatically provided. Each circuit is automatically tested

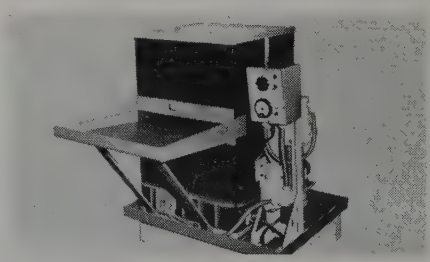


for predetermined limits of continuity and simultaneously tested against all other circuits commoned together for predetermined limits of shorts and high resistance leakage. Circuit errors, their type and location, are pinpointed on a matrix chart. Facilities for digital type print-out are provided. Functional tests are automatically performed on electro-mechanical devices such as relays, solenoids, stepping switches, etc. Testing capacity of the model 20 is 200 circuits and can be expanded to capacities of 400 or 800 circuits. DIT-MCO Inc., 911 Broadway, Kansas City, Mo.

Print No. Ins. 153 on Reader Service Card

Double-Sided Spray Machine For Etching Printed Circuits

New model 700 horizontal, double-sided spray etching machine is designed for fast, efficient etching of double or single-sided printed circuit boards and nameplates, and for chem-

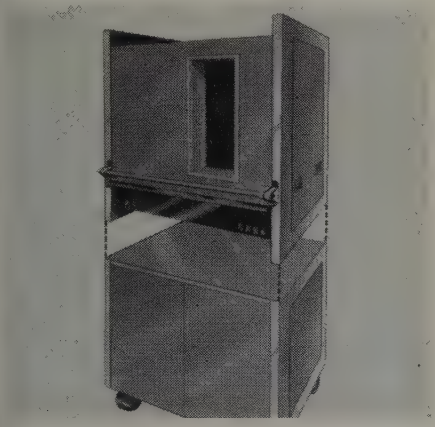


ical machining. Features listed are horizontal, two-sided, oscillating spray etching; fine lines etched with exceptional uniformity over entire board in less than two minutes using ferric chloride; and a drawer type work holding rack at waist height. Machine will handle board sizes up to 16″ x 19½″. Centre Circuits Inc., P.O. Box 165, 1101 North Atherton St., State College, Pa.

Print No. Ins. 154 on Reader Service Card

Largest Portable Test Chamber

A new portable temperature test chamber, said to be the largest available, has a testing area of 8 cu ft.

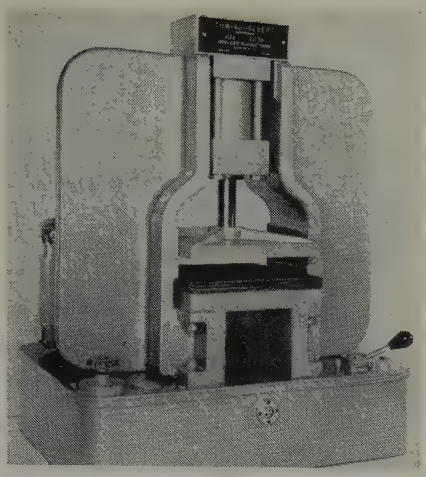


Designated the "MC" (Module Chamber), this unit operates from —100°F to +750°F with a reported accuracy of ±5°F. The heating and cooling rates are variable from 5°F per minute to 200°F per minute, depending upon the test load. Modular design of the MC is said to make it suitable for a wide variety of applications, including laboratory, production line, quality control, life testing, and plastics curing. Statham Instruments Inc., 12401 W. Olympic Blvd., Los Angeles 64.

Print No. Ins. 155 on Reader Service Card

Laboratory Sample Cutter for Large, Hard Samples

A new electro-hydraulically operated laboratory sample cutter, the model #240-4 Alfa, is adjustable and can apply up to 8 tons of pressure at the cutting surface. Finger tip operation is stated to make it possible to cut larger, thicker, and harder laboratory samples of such materials as paper, plastics, rubber, etc. Sample dies are said to make it possible to change from one size sample to another in seconds. Thwing-Albert In-

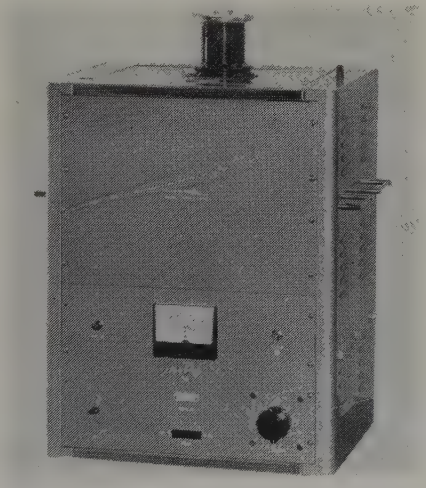


strument Co., Penn St. and Pulaski Ave., Philadelphia 44.

Print No. Ins. 156 on Reader Service Card

Corona-Free, High-Voltage Dielectric Strength Tester

A high-voltage dielectric strength tester, Model 4303 "Hypot," is constructed to eliminate creation of corona discharge and thus avoid interference with measurement of corona in circuits to be tested. Control of corona discharge reportedly is accomplished by provisions such as immersing all high-voltage components and meter multipliers in an oil-filled tank. The high-voltage output is through a

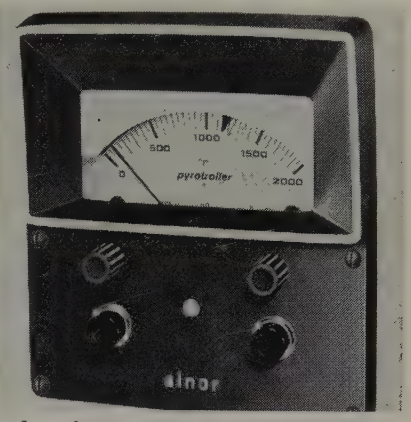


specially designed oil-filled bushing with corona ring. Model 4303 is available in 20, 30, and 35-kv units. Accessory corona pick-up network and corona detector with oscilloscope have been designed to provide a complete corona test system. Bulletin 4-65.4 available. Associated Research Inc., 3777 West Belmont Ave., Chicago 18.

Print No. Ins. 157 on Reader Service Card

New Temperature Indicator And Controller

An electronic on-off controller and pyrometric temperature indicator, called the "Pyrotroller," has been designed for use on ovens, heat treating furnaces, environmental test chambers, die casting machines, injection molding machines, extrusion presses, heat sealing machines, and a multi-



tude of processes requiring precise continuous control. The controller is available in 11 ranges from 0-400°F to 0-3000°F, as well as an environmental test chamber range of —100 to +300°F. Alnor Instrument Co., Division of Illinois Testing Laboratories Inc., 418 N. LaSalle St., Chicago 10.

Print No. Ins. 158 on Reader Service Card

Dates to Circle

Meeting and Convention Notices

Mar. 6-8 . . . ASTM, Committee D-9 on Electrical Insulating Materials, Sheraton Hotel, Louisville, Ky.

Mar. 7-10 . . . ASTM, Committee D-20 on Plastics, Sheraton Hotel, Louisville, Ky.

Mar. 9-10 . . . Symposium on Engineering Aspects of Magnetohydrodynamics, AIEE, IAS, IRE, and Univ. of Pa., University Park, Philadelphia, Pa.

Mar. 14 . . . SPE, Plastics Finishing Seminar, Retec sponsored by Southern California Section and PAG on Finishing, Roger Young Auditorium, Los Angeles.

Mar. 15-17 . . . EIA, Spring Conference, Washington, D.C.

Mar. 20-23 . . . IRE, National Convention, Coliseum and Waldorf-Astoria Hotel, New York City.

Mar. 21-22 . . . Institute of Printed Circuits, Annual Meeting, Barbizon Plaza Hotel, New York City.

Mar. 21-25 . . . Electrical Engineers Exhibition, Earls Court, London. For information, contact Electrical Engineers Exhibition Ltd., 6 Museum House, 25 Museum St., London, W.C.I.

Apr. 4-5 . . . SPE, Plastics Injection Molding Workshop, Retec sponsored by Pioneer Valley Section and PAG on Injection Molding, Holy Cross College, Worcester, Mass.

Apr. 5-7 . . . AIEE, South East District Meeting, Jung Hotel, New Orleans, La.

Apr. 5-7 . . . ASTM, Symposium on Materials and Electron Device Processing, Benjamin Franklin Hotel, Philadelphia.

Apr. 10-11 . . . Rubber and Plastics Industries Conference, Sheraton Hotel, Akron, Ohio.

Apr. 17-21 . . . American Welding Society, Annual Convention and Welding Exposition, Commodore Hotel and New York Coliseum, New York City.

Apr. 19-21 . . . AIEE, Great Lakes District Meeting, Hotel Pick-Nicolett, Minneapolis, Minn.

Apr. 19-21 . . . Annual Southwestern Institute of Radio Engineers Conference & Electronics Show, Dallas Memorial Auditorium and The Baker Hotel, Dallas, Texas.

Apr. 20-21 . . . SPI, 18th Annual Western Section Conference, Hotel del Coronado, Coronado, Cal.

Apr. 26-28 . . . IRE, 7th Region Technical Conference & Trade Show, Westward Ho Hotel, Phoenix, Ariz.

Apr. 30-May 4 . . . Electrochemical Society, Spring Meeting, Claypool Hotel, Indianapolis, Ind.

May 1-2 . . . AIEE, Rural Electrification Conference, Kentucky Hotel, Louisville, Ky.

May 2-4 . . . Electronic Components Conference, AIEE, IRE, EIA, and WEMA, Jack Tar Hotel, San Francisco.

May 7-8 . . . IRE, 5th Midwest Symposium on Circuit Theory, University of Illinois, Urbana, Ill.

May 8-9 . . . SPI, Nineteenth Canadian Section Conference, Sheraton-Brock Hotel, Niagara Falls, Ont., Canada.

May 8-10 . . . IRE, NAECON, Miami and Biltmore Hotels, Dayton, Ohio.

May 9-11 . . . Western Joint Computer Conference, sponsored by AIEE, IRE, and Assoc. of Computer Manufacturers, Ambassador Hotel, Los Angeles.

May 17-19 . . . AIEE, North Eastern District Meeting, Statler Hotel, Hartford, Conn.

May 23 . . . AIEE, Fractional Horsepower Motors Conference, Biltmore Hotel, Dayton, Ohio.

May 24-26 . . . EIA, 37th Annual Convention, Chicago.

June 5-9 . . . SPI, Annual National Plastics Conference and Exposition, Commodore Hotel and the Coliseum, New York City.

June 11-14 . . . NISA, Annual Convention, Jack Tar Hotel, San Francisco, Cal.

June 11-15 . . . American Society of Mechanical Engineers, Semiannual Meeting, Statler-Hilton Hotel, Los Angeles, Cal.

June 18-23 . . . AIEE, Summer General Meeting, Cornell University, Ithaca, N. Y.

June 21-July 1 . . . International Plastics Exhibition and Convention, Olympia, London, England. Address inquiries to: Interplas '61, Dorset House, Stanford St., London S.E. 1, England

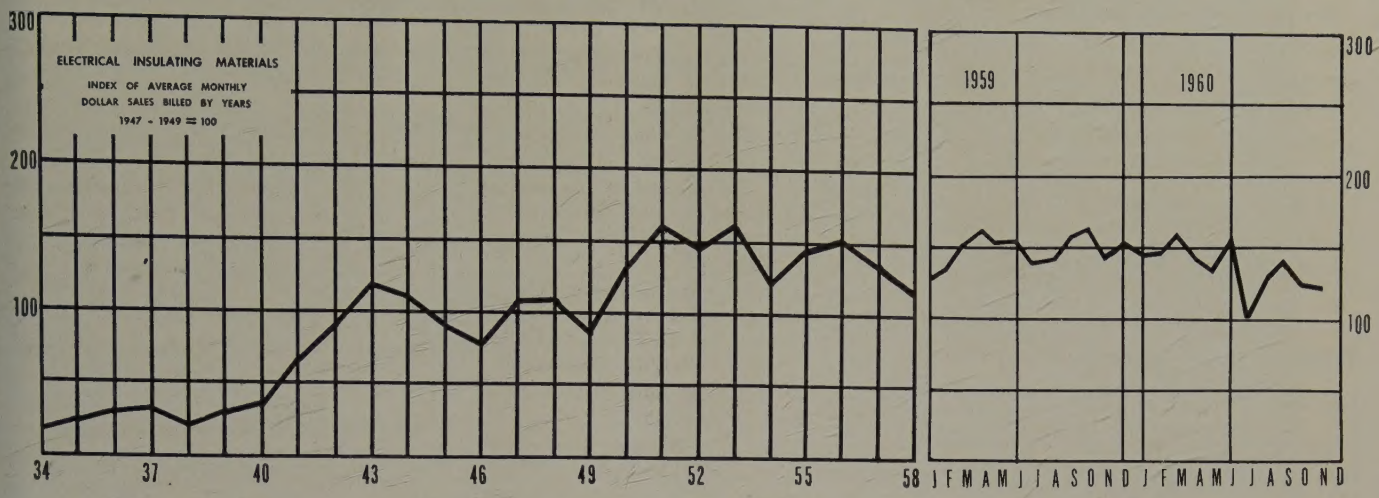
June 25-30 . . . ASTM, 64th Annual Meeting, Chalfonte-Haddon Hall, Atlantic City, N. J.

June 26-30 . . . Western Summer Radio-Television and Appliance Market (Division of Western Home Goods Market), Western Merchandise Mart, San Francisco, Cal.

Abbreviations Used in Notices

AIEE	—American Institute of Electrical Engineers
ASTM	—American Society for Testing Materials
ASME	—American Society of Mechanical Engineers
ASA	—American Standards Assn.
IRE	—Institute of Radio Engineers
EIA	—Electronic Industries Assn.
NEMA	—National Electrical Manufacturers Assn.
NISA	—National Industrial Service Assn.
SPE	—Society of Plastics Engineers
SPI	—Society of the Plastics Industry
WEMA	—Western Electronic Manufacturers Assn.

NEMA Electrical Insulation Index



	Nov. '60	Oct. '60	Nov. '59
Index Series	123	124	141
Nov. '60 point change from other mos.		—1	—18
Nov. '60 % change from other months		—1	—13

Index is based on 1947-1949 average month, inclusive= 100

Published through the courtesy of the National Electrical Manufacturers Association

Materials Used in Electrical Insulation Index

Industrial Laminated Products
Manufactured Electrical Mica
Flexible Electrical Insulation
Vulcanized Fibre
Coated Electrical Sleeving

Advertisers' Index

To obtain more information on products of Insulation *advertisers, just print the advertisement number shown for each advertiser in one of the spaces on the Reader Service Inquiry Card on the inside back cover. This number appears under each advertisement and is also repeated in the listing below. After filling out the card completely, tear it off and drop it in the mail—no postage required.* Insulation *will promptly forward your requests for further information to the advertisers.*

Number	Advertiser	Page
Ins. 47	Acme Resin Corp.	75
Ins. 11	Allied Chemical Corp., Plastics Div.	15
Ins. 12	American Enka Corp., Wm. Brand-Rex Div.	16
Ins. 37	Anaconda Wire & Cable Co.	61
Ins. 55	Atlantic Yarn Corp.	83
Ins. 30	Atlas Asbestos Co.	48
	Belden Manufacturing Co.	21
Ins. 1	Bentley-Harris Manufacturing Co.	Inside Front Cover
Ins. 38 & 60	James G. Biddle Co.	62 & 87
Ins. 5	The Blane Corp.	7
Ins. 58	E. J. Cady & Co.	86
Ins. 56	Cincinnati Development & Mfg. Co.	85
	Continental-Diamond Fibre Corp.	59
Ins. 13	Coors Porcelain Co.	17
Ins. 25	Cottrell Paper Co., Inc.	36
Ins. 33	Del Electronics Corp.	53
Ins. 50	Dia-Chrome Inc.	80
Ins. 7	John C. Dolph Co.	11
Ins. 19	Dow Corning Corp.	24 & 25
Ins. 28	E. I. du Pont de Nemours & Co. (Inc.), Film Dept.	44
Ins. 40	Essex Wire Corp., Magnet Wire Div.	65
	General Electric Co.	
Ins. 27	Insulating Materials Dept.	37
Ins. 34	Silicone Products Dept.	55
Ins. 61	The Glastic Corp.	Inside Back Cover
Ins. 59	J. J. Glenn and Co.	87
Ins. 57	Gries Reproducer Corp.	86
Ins. 45	Grieve-Hendry Co., Inc.	73
Ins. 35	Gudebrod Bros. Silk Co., Inc., Electronic Div.	56
Ins. 26	H. F. Hanscom & Co., Inc.	36
Ins. 17	Hess, Goldsmith & Co., Inc., Horace Linton Div.	22
Ins. 43	Hudson Wire Co., Ossining Div.	71
Ins. 64	Hull Corp.	52
Ins. 44	The Huse-Liberty Mica Co.	73
Ins. 14	Industrial Instruments, Inc.	18
Ins. 3	Insulation Manufacturers Corp.	2
Ins. 42	L. Frank Markel & Sons	67
Ins. 8	Midwest Molding & Manufacturing Co.	12
Ins. 63	Natvar Corp.	9
Ins. 15	New Jersey Wood Finishing Co.	19
Ins. 32	Paterson Parchment Paper Co.	51
Ins. 54	Pelmor Laboratories, Inc.	83
Ins. 22	Pennsylvania Fluorocarbon Co., Inc.	30
Ins. 29	Peschel Electronics, Inc.	48
Ins. 9	Phelps Dodge Copper Products Corp.	13
	Plastics Design & Processing	63
Ins. 20	Plymouth Rubber Co., Inc.	27
Ins. 2	Prehler Electrical Insulation Co.	1
Ins. 48	Raybestos-Manhattan Inc., Plastic Products Div.	77
Ins. 4	Rayclad Tubes Inc., A Subsidiary of Raychem Corp.	5
Ins. 62	Rea Magnet Wire Co., Inc.	Outside Back Cover
Ins. 24	The Richardson Co.	32
Ins. 16	Riegel Paper Corp.	20
Ins. 46	Rostone Corp.	73
Ins. 18	Schenectady Varnish Co., Inc.	23
Ins. 21	Shawinigan Resins Corp.	28
Ins. 31	Spaulding Fibre Co.	49
Ins. 52	Spellman High Voltage Co.	82
Ins. 53	Star Porcelain Co.	82
Ins. 23	Sylvania Electric Products, Inc., Parts Div.	31
Ins. 49	Taylor Fibre Co.	78 & 79
	Union Carbide Corp.	
Ins. 36	Union Carbide Plastics Co., Div.	57
Ins. 51	Varflex Sales Co., Inc.	81
Ins. 6	Western Sky Industries	10
Ins. 41	Westinghouse Electric Corp., Micarta Div.	68 & 69
Ins. 10	West Virginia Pulp & Paper Co.	14

Advertising Sales Offices:
Libertyville, Ill.—(General Offices) P.O. Box 270, 311 E. Park Ave. Phone EMpire 2-8711
Chicago 11, Ill.—John MacKay and Philip Holmes
410 N. Michigan Ave. Phone WHitehall 4-2883
Detroit 26, Mich.—Charles R. Schroeder
413 Lafayette Bldg. Phone WOodward 1-0278
New York 17, N.Y.—Robert Bandini and Roland Robitaille
41 E. 42nd St. Phone MUrray Hill 2-3157
Pacific Coast—H. L. Mitchell & Assoc., 1450 Lorain Road. San Marino, Calif. Phone CUmberland 3-4394
(Central California only—James T. Stevenson, 5901 Buena Vista Ave., Oakland 18, Calif. Phone OLympic 3-8602)

RESISTRAC® Premix Molded Parts...

1000 Times Greater Track Resistance in Your Insulating Components

ABOVE: 10-sec. time exposure shows insulating molding compound sample subjected to ASTM suggested dust & fog test. 1500 volts applied between electrodes causes arcing on the moist, contaminated surface.

LEFT: Molding compound samples after test. Phenolic tracked to ground in 27 min. RESISTRAC is eroded after 648 hrs. but exhibits no carbon tracking.

This fiber glass reinforced alumina-polyester combines resistance to carbon treeing and dimensional stability approaching that of ceramics, and the toughness and precision of plastics. RESISTRAC offers the designer a material free from the tracking limitations of thermosetting plastics and without the shortcomings of ceramics.

Consider this excellent *combination* of properties:

Outstanding Track Resistance—50 times the tracking resistance of conventional fiber glass polyester premix. 1000 times the tracking resistance of phenolics.

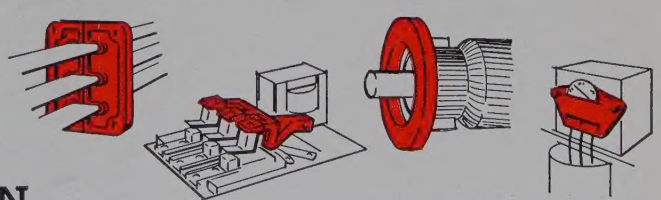
Flashover Resistance—Unlike ceramics, it gives shatter proof performance under the thermal shock of power flashover.

Chipping Resistance—From 3 to 6 foot pounds Izod impact strength compared with .05 to 1.0 foot pounds for most ceramics.

Flame Resistance—Completely self extinguishing within 50 seconds, max., under Fed. Spec. LP 406b test procedure.

These advantages plus heat resistance, low moisture absorption, and excellent moldability can offer real product improvement in your apparatus. And full design utilization of the properties can result in significant cost savings.

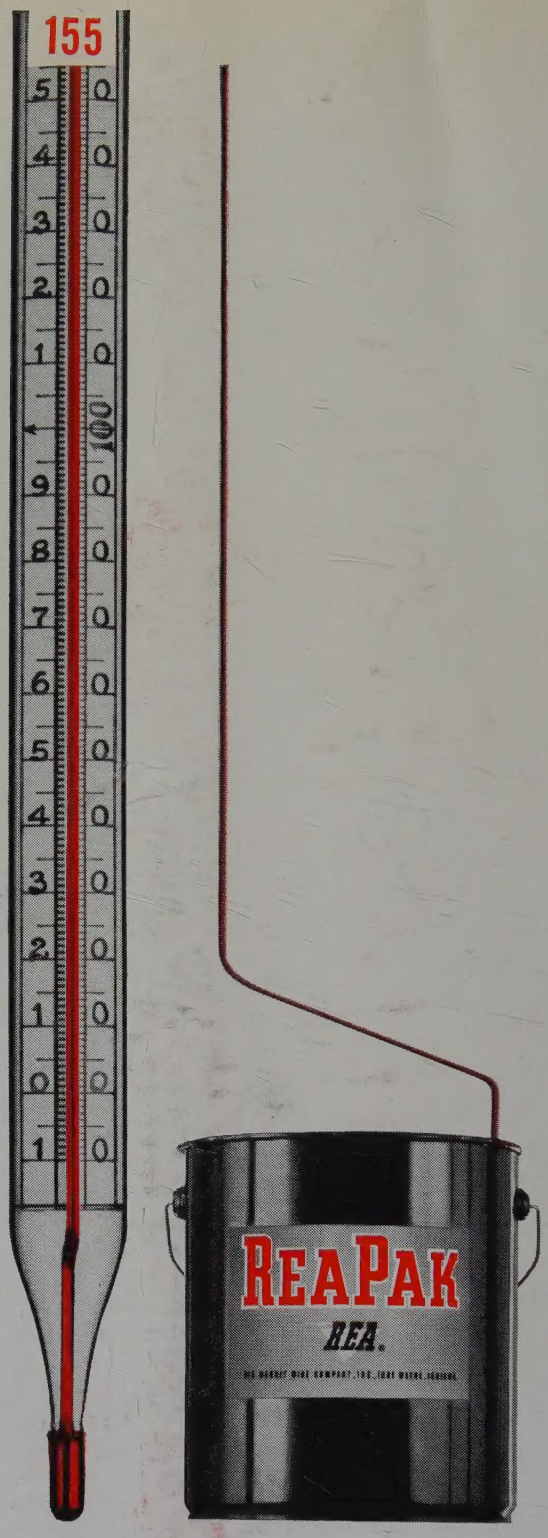
RESISTRAC is available in custom molded parts and molding compound as well as sheet stock. Write for data.



THE GLASTIC® CORPORATION
21 Glenridge Road Cleveland 21, Ohio

Users of Glastic RESISTRAC are licensed for its application as covered in U.S. Patent 2,768,264.

Print Ins. 61 on Reader Service Card



Ask your Rea man about versatile POLY-THERMALEZE... for 155°C operation

He'll describe an improved polyester magnet wire that offers increased resistance to abrasion, solvents and heat shock . . . while retaining vital moisture resistance characteristics. Rea POLY-THERMALEZE* is a Class F (155°C) polyester-film, insulated wire available at the cost of standard Class A (105°C) magnet wires. Thus, it is applicable to either Class A (105°C), Class B (130°C) or Class F (155°C) electrical apparatus. Rea POLY-THERMALEZE embodies an unusually good combination of physical, chemical, thermal and electrical characteristics. And it's available in the famous ReaPak® container or standard spools and reels. Call your Rea man today—or write to us in Fort Wayne for samples and more information.

*Licensed by Phelps-Dodge Copper Products Corp.

REA®

Copper and Aluminum Magnet Wire, All Insulations

REA MAGNET WIRE COMPANY, INC. • *Division of Aluminum Company of America* • Dept. 1930-C, Fort Wayne, Indiana • TWX: FW18

Print Ins. 62 on Reader Service Card